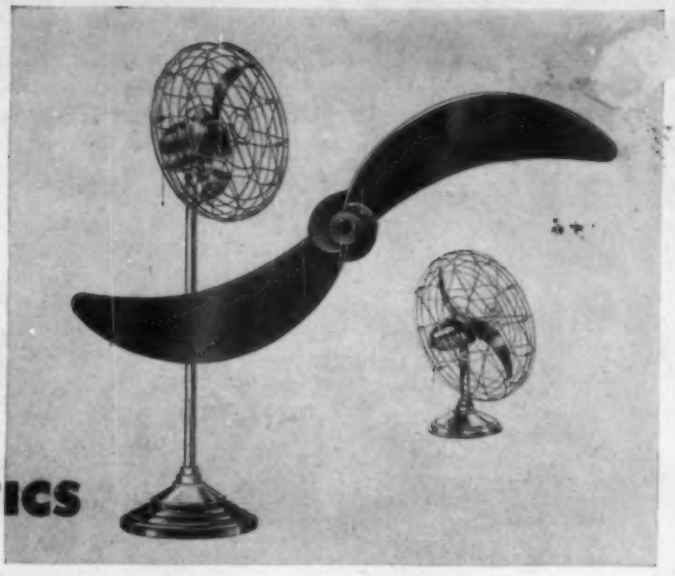
MODERN PLASTICS

JUNE 1946

"CLEARING THE AIR" ABOUT PHENOLIC PLASTICS



The use of plastics by industry is increasing daily on a scope that is practically universal. Nevertheless, there still exists much confusion about the different types of plastics, their properties and their uses. The purpose of this message is to help "clear the air" about phenolics —the most versatile of all plastics... the type of plastics which Durez has specialized in producing for the past twenty-six years.

The custom molded Durez propeller illustrated is the first plastic propeller that has been developed for such use . . . marks a new step forward for the plastics industry. In varying sizes, it is used by the Fresh'nd-Aire Company in several of their most popular Fresh'nd-Aire Circulators.

Why Plastics?

Moldability — a common denominator of all plastics — naturally makes them highly desirable for producing an item of this sort — provided, of course, several other necessary properties exist.

Why Phenolic Plastics?

Because the Fresh'nd-Aire propeller must be statically and dynamically balanced to perfection and because it revolves at high speeds, good dimensional stability was of paramount importance.

The only plastic material which would provide this property and meet other requirements such as impact strength, heat resistance, tensile strength, and low-cost production, was a phenolic.

Why Durez Phenolic Plastics?

As specialists in the production of phenolic plastics, Durez offers more than 300 versatile phenolic molding compounds — each scientifically developed for a specific purpose — from which to select the plastic that precisely fits the job.

Furthermore, Durez laboratory technicians possess a rich background of successful product development experience which makes their services invaluable in solving any unusual plastic material problem.

Expert Assistance Available

The services of the Durez staff are available at all times to you and your custom molder. Durez Plastics & Chemicals, Inc., 56 Walck Road, North Tonawanda, New York. *Export Agents: Omni Products Corporation, 40 East 34th Street, New York 16, New York.*

PLASTICS THAT FIT THE JOB

From a well-developed *Catalin* chest the ELECTROAIRE* breathes purifying Ozone into room atmosphere

Purified mountain-top Ozone comes down to earth to serve the home. One of the promises of the future—now here!

Housed in a smartly designed, gem-like, colorful Catalin cabinet, the Electroaire functionally transforms indoor air into "the breath of the great outdoors". It destroys smoke and food odors; refreshes stuffy atmosphere, promotes health. The Electroaire is portable—you connect it as you would a table radio—it may be moved from room to room. Decoratively, as an appointment, it also contributes a *quality atmosphere* of beauty, luxury and fitness.

This application of Catalin is that of a simple draw casting, the grill openings being provided in the arbor. Catalin casting techniques are now so highly advanced as to place no restrictions upon a projected product's size, shape or intricacy of design. With Catalin, you incur no expensive custom mold costs. In many instances, standard Catalin shapes satisfy product specifications. The members of our experienced staff gladly welcome an opportunity to lend a hand to those who are planning to manufacture products of plastics.

CATALIN CORPORATION
ONE PARK AVENUE, NEW YORK 16, N. Y.

*Manufactured by ELECTROAIRE CORP., L. I. City, N. Y.

CATALIN
THE GEMS OF PLASTICS
Catalin

CAST RESINS • LIQUID RESINS • MOLDING COMPOUNDS

MODERN PLASTICS*

AND PLASTICS*

VOLUME 23 JUNE 1946 NUMBER 10

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* Reg. U. S. Patent Office.

All these — and a lot more — from GEON raw materials

Here are just a few of the thousands of products that can be made from GEON polyvinyl materials. Upholstery material, for example, that is practically wearproof, easy to clean because dirt or ink or even acid can't penetrate the surface; a dish drainer and drain mat that won't ever get gummy from the effects of soaps or foods; colorful, dirt and chemical resistant floor tile that can't be marred or scuffed; lovely handbags that can be washed again and again and never lose their attractive appearance; handsome luggage that is practically indestructible; mirror-finish materials for shoe parts and other applications.

Note that these are all applications of calendered or molded sheet. In addition, GEON can be cast or calendered as film, pressure or injection molded, and extruded. In solution or latex forms GEON can be used to coat fabrics and fibres of all kinds as well as paper and board. In all these forms it can be made to resist sunlight, heat, cold, aging, oils and greases, acids and alkalies, abrasion and wear, water, and most other normally destructive factors.

Rainwear, packaging materials, acid tank linings, fly swatters, wire and cable insulation are just a few examples of the wide variety of applications for GEON. While we make no finished products of GEON, we'll be glad to work with you on any special problems or applications. Just write Dept. I-6, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

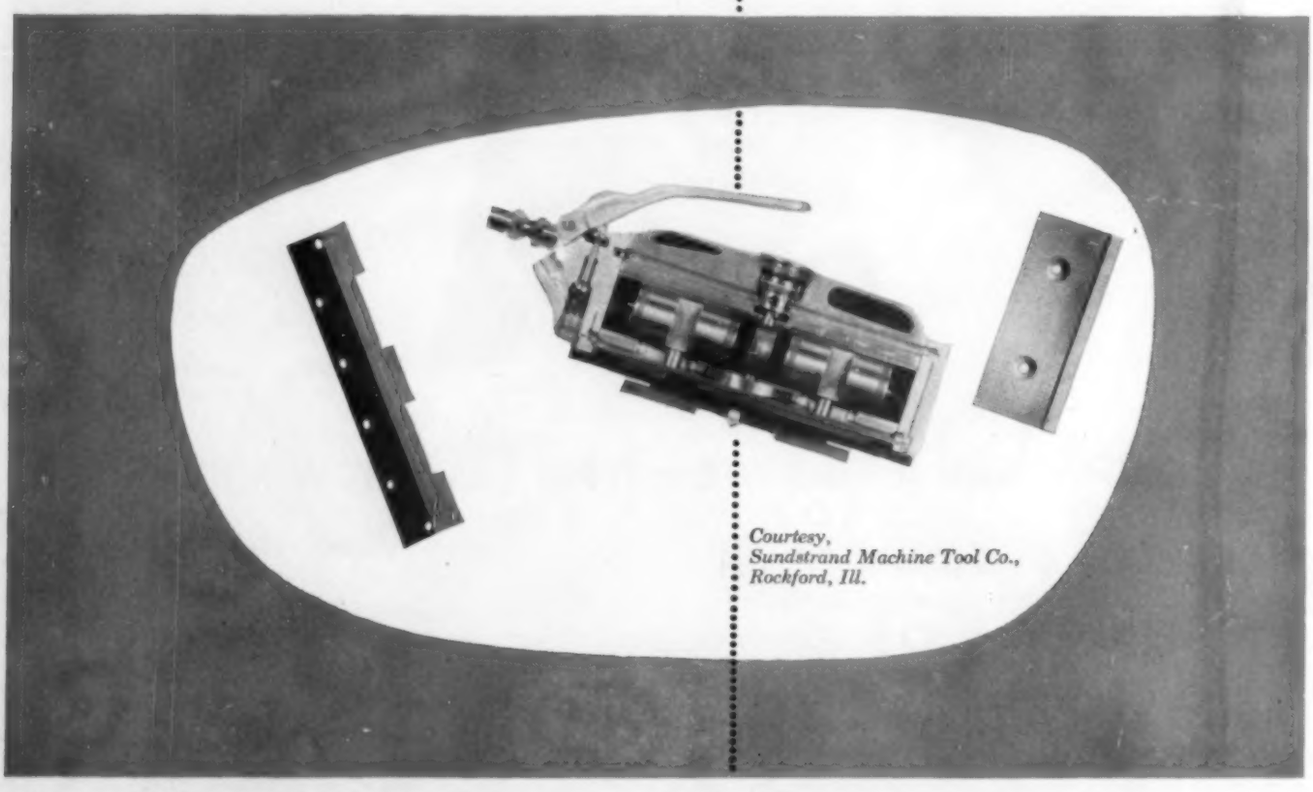
Case Histories from the **RICHARDSON** *files*

PRODUCT DURABILITY

Problem: *To improve life and service of gibs and retainer plates on high speed sanders. Parts must be able to withstand considerable abuse.*

Solution: The problem was solved by the use of plastics. From the big family of INSUROK Precision Plastics, Richardson Plasticians selected Laminated INSUROK, grade CG. For this material has a high natural graphitic content and is especially suited for parts subject to friction and hard usage.

For many years Richardson has been helping to solve the plastics problems of industry. Our experience is at your service. You will find it a diversified service, with skilled plasticians ready to help you mold or laminate whatever grade and type of INSUROK is best for your application.



Courtesy,
Sundstrand Machine Tool Co.,
Rockford, Ill.

INSUROK *Precision Plastics*

The RICHARDSON COMPANY

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Factories { MELROSE PARK, ILLINOIS
NEW BRUNSWICK, NEW JERSEY
INDIANAPOLIS 1, INDIANA

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BRANCH OFFICES:
Chicago 1, 221 N. LaSalle St.,
Tel.: Randolph 5588
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Tel.: Superior 0737
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Member Audit Bureau of Circulations

MODERN PLASTICS is regularly indexed in the Industrial Arts Index and in Industex.

When scarcity turns to plenty

Why has the plastics raw material supply for molders failed to keep up with demand? From the very clear explanation given by W. S. Landes, president of P.M.M.A. and vice president of Celanese Corp. of America, in his speech before the S.P.I. meeting in April, it would seem that the two most important factors probably are:

1. Molding capacity has increased in far greater proportion than capacity for manufacturing materials to use in the molds.
2. Production of all civilian goods is at the highest peak in all history and plastics is caught in this upward spiral.

This shortage is an amazing situation to many plastic experts who feared raw material surpluses would haunt the industry after hostilities ceased. It is generally conceded that an equilibrium in plastics materials supply and demand will be reached soon.

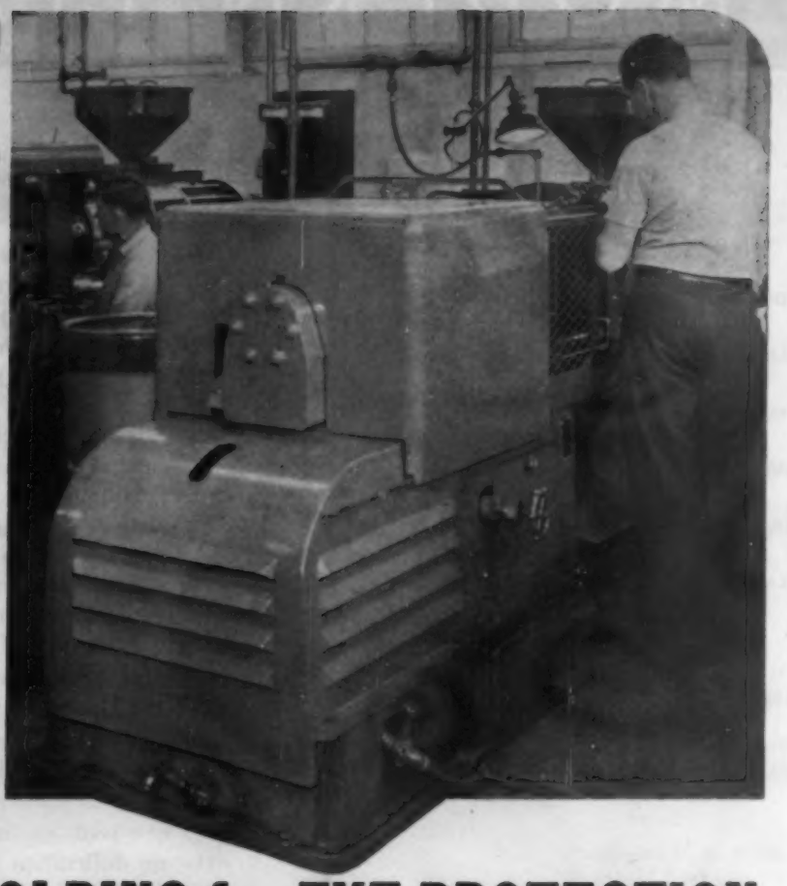
Take a look at the record for molding materials alone: about 100,000,000 lb. were consumed in 1939. In January 1946, the industry was consuming at a rate of 300,000,000 lb., according to U. S. Census figures. This threefold increase of molding material over a 6-year wartime period was slow, laborious and marked by extreme difficulties in securing physical equipment needed for expansion. During that period, phenolics and ureas doubled, cellulosics increased more than six times and polystyrene jumped from practically zero to more than 3,000,000 lb. in February 1946.

Mr. Landes, in his address before the S.P.I., pointed out that at the beginning of 1947 production of molding and extrusion materials should be 490 percent of 1939, or approximately 500,000,000 lb. a year. That is nearly twice as much as 1944. If the raw materials producers can double production of molding materials in two such years as 1945 and 1946, what can they do when more equipment becomes easily available?

New presses and increased efficiency will be more than enough to take care of the 1946 and 1947 increased production of molding materials, according to Mr. Landes. But by the end of 1947 a different economic structure will confront the plastics industry. Competitive materials will probably be in much greater supply than now. The market for many goods will be saturated. Customers will have a chance to choose between items rather than take whatever is offered. The amount of molding material available could well be sufficient to meet all needs.

That day may be late in 1947 or even 1949, but it is not too early to make plans to meet it. In a study conducted by a large chemical manufacturer, it was found that the average time lag between the initial call and first sale to a customer was about three years. It takes time to build up sound customer relationships.

It is possible that today's overwhelming demand for molded plastics goods is an economic phenomena brought on by topsy-turvy world conditions. It may be that in one or two years, molders will have to dig like gophers to dispose of their capacity output. The safest way to prevent a slow-down two years from now is to start an intelligent research and sales program today. No excuse such as lack of time today will pay for idle press time later on.

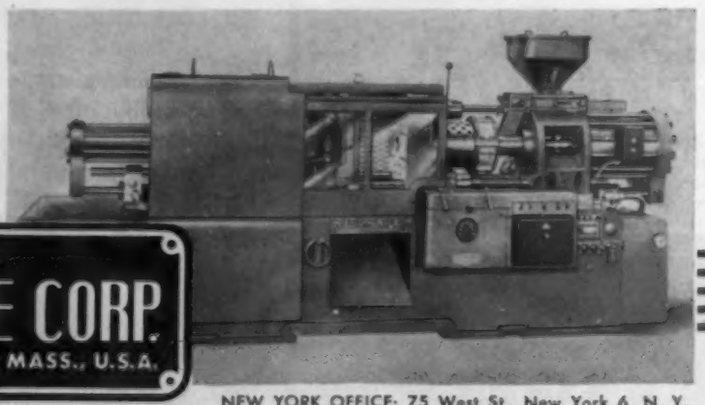


INJECTION MOLDING for EYE PROTECTION

American Optical Company of Southbridge, Massachusetts, enjoys an international reputation for producing ophthalmic materials, safety products and scientific instruments of unmatched quality and precision — a reputation due in part to their use of machines of the highest standards of performance. For efficiency and precision in molding temples, nose pads and frames for sun glasses; eye cups and frames for industrial safety goggles, they rely on REED-PRENTICE plastic injection molding machines (8 and 4 ounce shown above).

You can depend on Reed-Prentice machines for precision and economy in all kinds of injection molding operations. Models available in 22, 16, 12, 8, 6 and 4 ounce sizes. Write today for complete information.

The 6 and 8 ounce model Reed-Prentice Plastic Injection Molding Machine (right) is part of the World's largest selling line.



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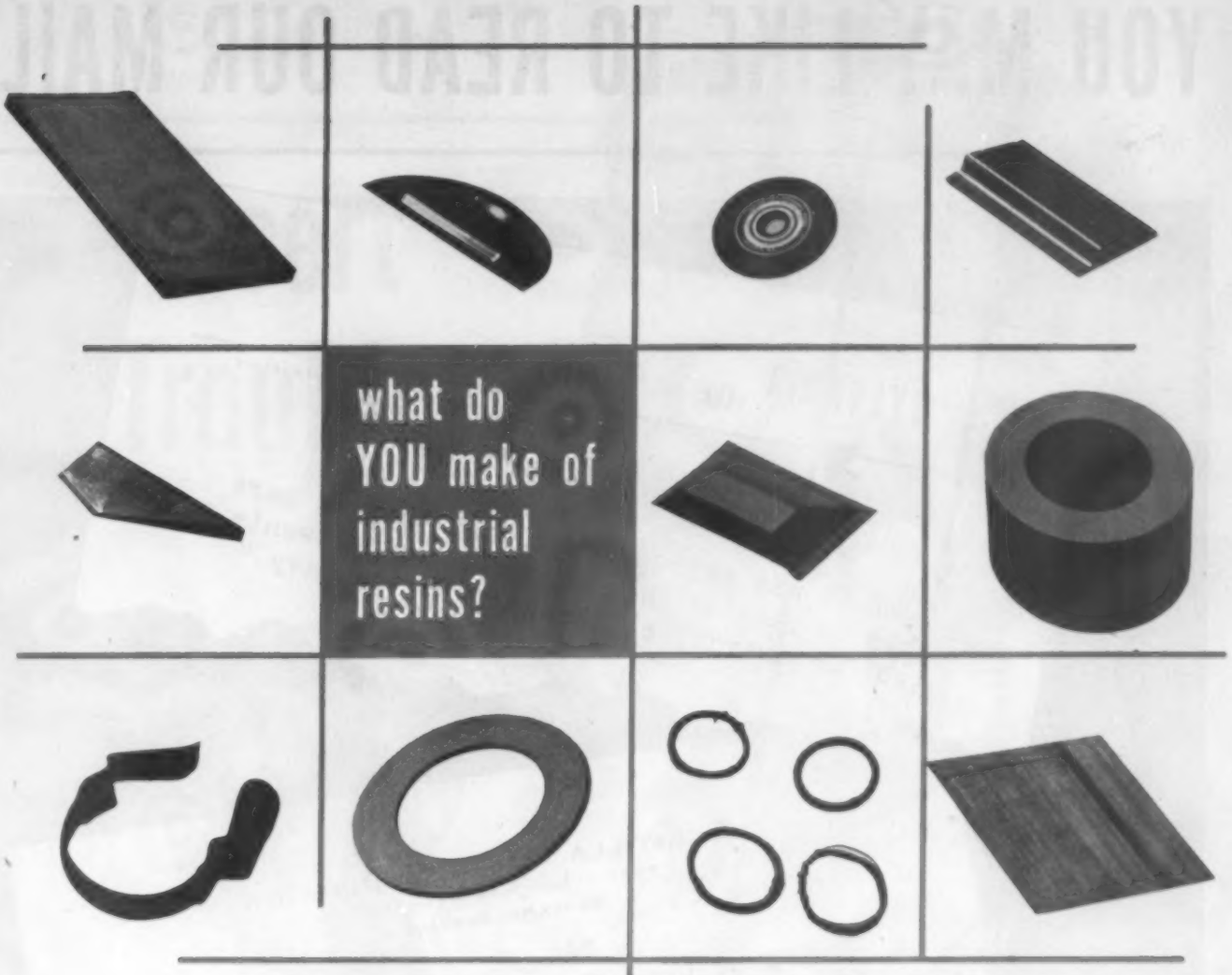


Unless you've fully investigated *lately* the many applications of Resinox industrial resins . . . it's possible you're missing an opportunity to use and profit by these versatile, useful thermosetting resins.

New applications in the field of laminating, bonding, and impregnating come to attention almost daily now as molders, designers, materials researchers, are reconverting, redesigning, and bringing forth new materials.

Resinox: Reg. U. S. Pat. Off.

MONSANTO
PLASTICS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

No matter what you make or design, it may pay you well to scan this skeleton application list of Resinox industrial resins:

Laminating resins . . . for laminating wood veneers, paper, and fabric into tough, impact-resistant laminates for a variety of purposes . . . wall paneling, gears, safety helmets, electrical insulators, radio parts, furniture, airplane parts, etc. They can be prepared to offer excellent electrical properties, chemical resistance, postforming qualities and resistance to weather and aging.

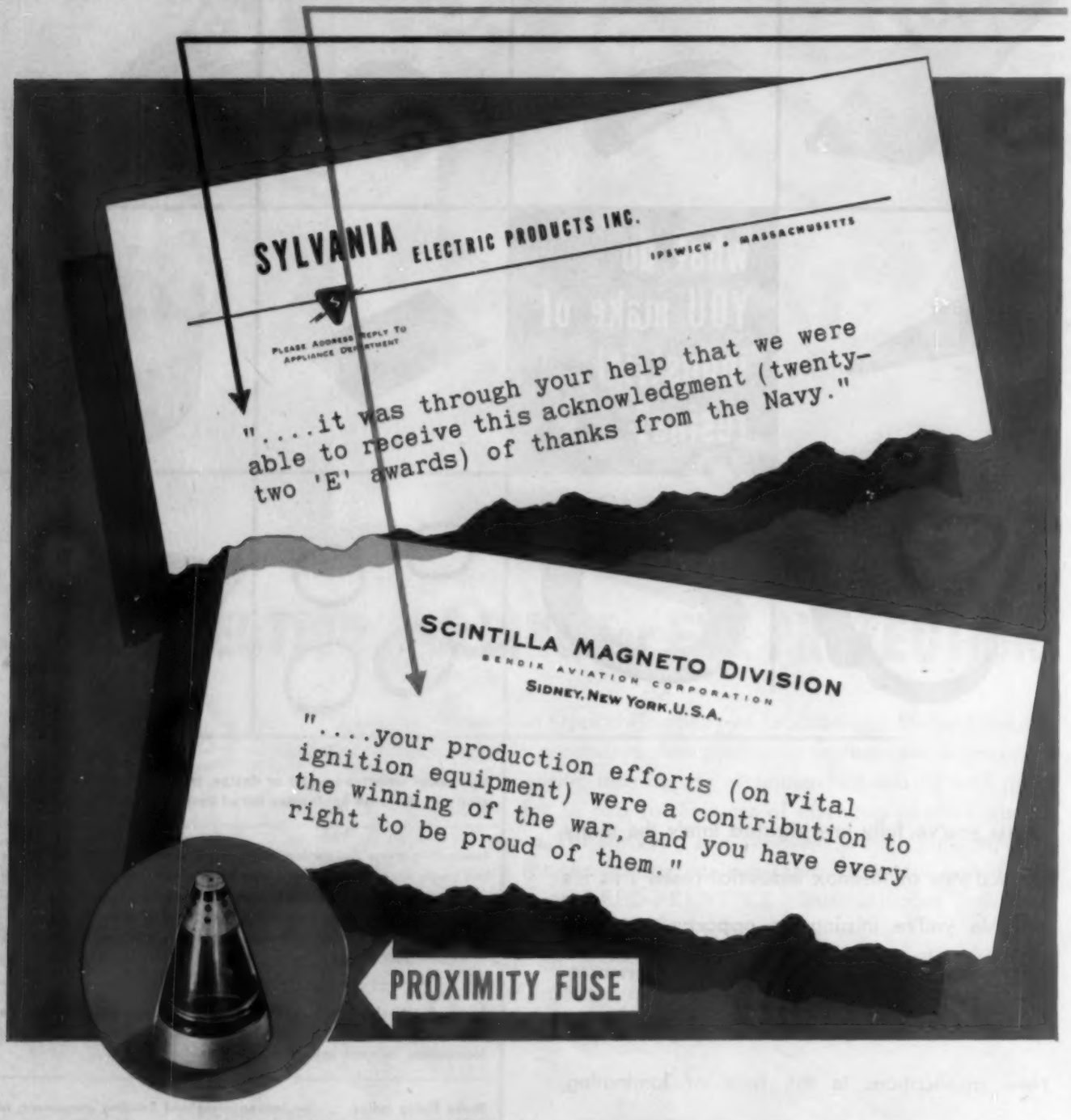
Grinding wheel resins . . . for binding the components of abrasive wheels into stronger, more dense and more resilient wheels. Special formulations to meet special requirements.

Brake lining resins . . . for impregnating and bonding components of high friction, long wearing, tough, stable brake linings and clutch facings.

Liquid resins . . . for saturating paper suitable for plywood overlays, for bonding glass and mineral wool insulation into handy bats, for wire enameling and for special adhesive purposes.

If you have any ideas or any questions about industrial resins and how they might help you, call Monsanto Plastics resin experts. Long years of experience in this specialized field qualifies them well to give you genuine help. Technical data or samples, also, are yours for the asking. Write, wire or phone: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

YOU MAY LIKE TO READ OUR MAIL



PROLON PLASTICS

● We are prepared to do any sort of plastics process . . . to help you with any kind of plastics problem. Just get in touch with us.

A Division of the PRO-PHY-LAC-TIC BRUSH CO., Florence, Mass.

Insert Trouble-

Just like plastics used to have!

Plastics buyers used to find some metal inserts a lot like a loose tooth—necessary in function, but unstable, liable to wander, and very apt to produce sharp pains (in the pocketbook). Incidentally, so did we custom molders.

But now Heatronic molding (using radiofrequency pre-heating) has changed all that, and very definitely for the better. Heatronics gives much greater plasticity to the material in the mold and at the same time reduces the amount of pressure required. This easier flow, on the identical jobs in which inserts used to shear or float at times, today cuts rejects down to the vanishing point.

You'll find plenty of other reasons, too, why Heatronics is considered the greatest forward stride made by plastics in many years. Come to Kurz-Kasch for practical information—on them and their application to your molding problems. Why? Because Kurz-Kasch *pioneered* Heatronics for plastics—because we have one of the *finest installations* in the industry—and because we know Heatronics *right now* just as thoroughly as we know custom molding.

Kurz-Kasch

For Over 29 Years
Planners and Molders in Plastics

Kurz-Kasch, Inc., 1415 S. Broadway, Dayton 1, Ohio. *Export Offices:* 89 Broad Street, New York, New York.
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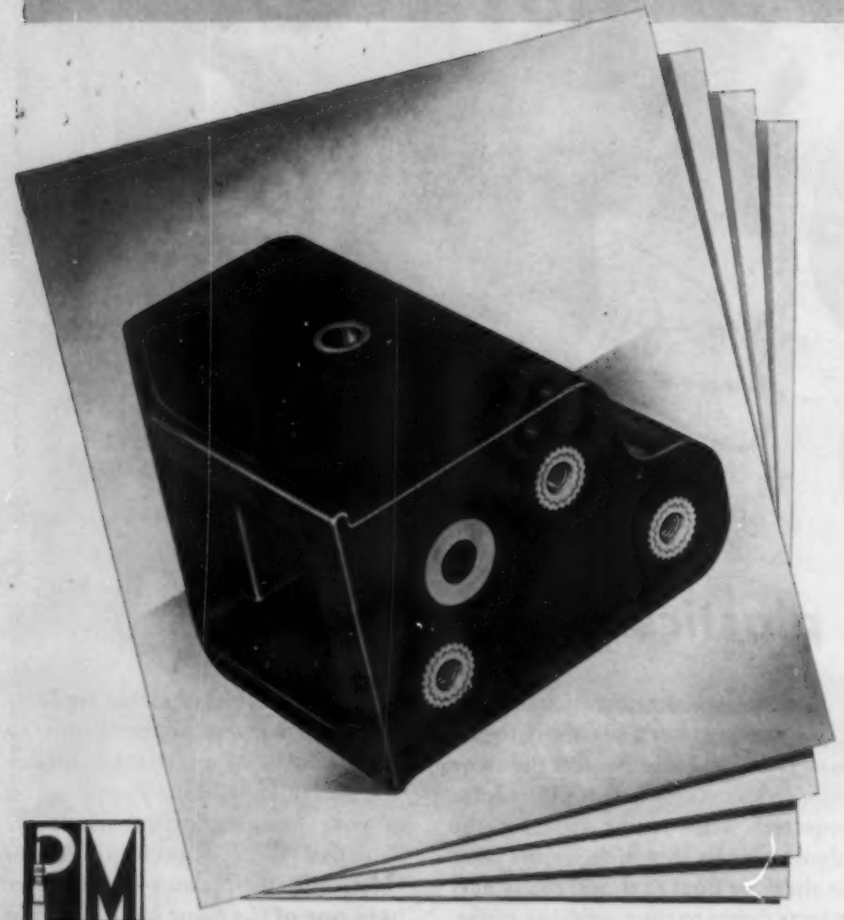
an example from Our Production Files

ENGINEERED PLASTICS

FROM DESIGN TO FINISHED ASSEMBLY



PM
REG. U.S. PAT. OFF.

MOLDED PLASTIC GEAR HOUSING

This molded part is designed for geared trim tab control on aircraft and is engineered to close tolerances. Contains metal inserts, molded in. Plastic gear housings can be produced at lower cost than machined metal castings. Specific performance requirements may be met thru proper plastic formulations, determined by our plastics chemists.

Let us help you obtain the most practical applications of plastics to your needs. We are experienced in combining plastics with complementary metals, to achieve service features that are unobtainable by the exclusive use of either type of material.

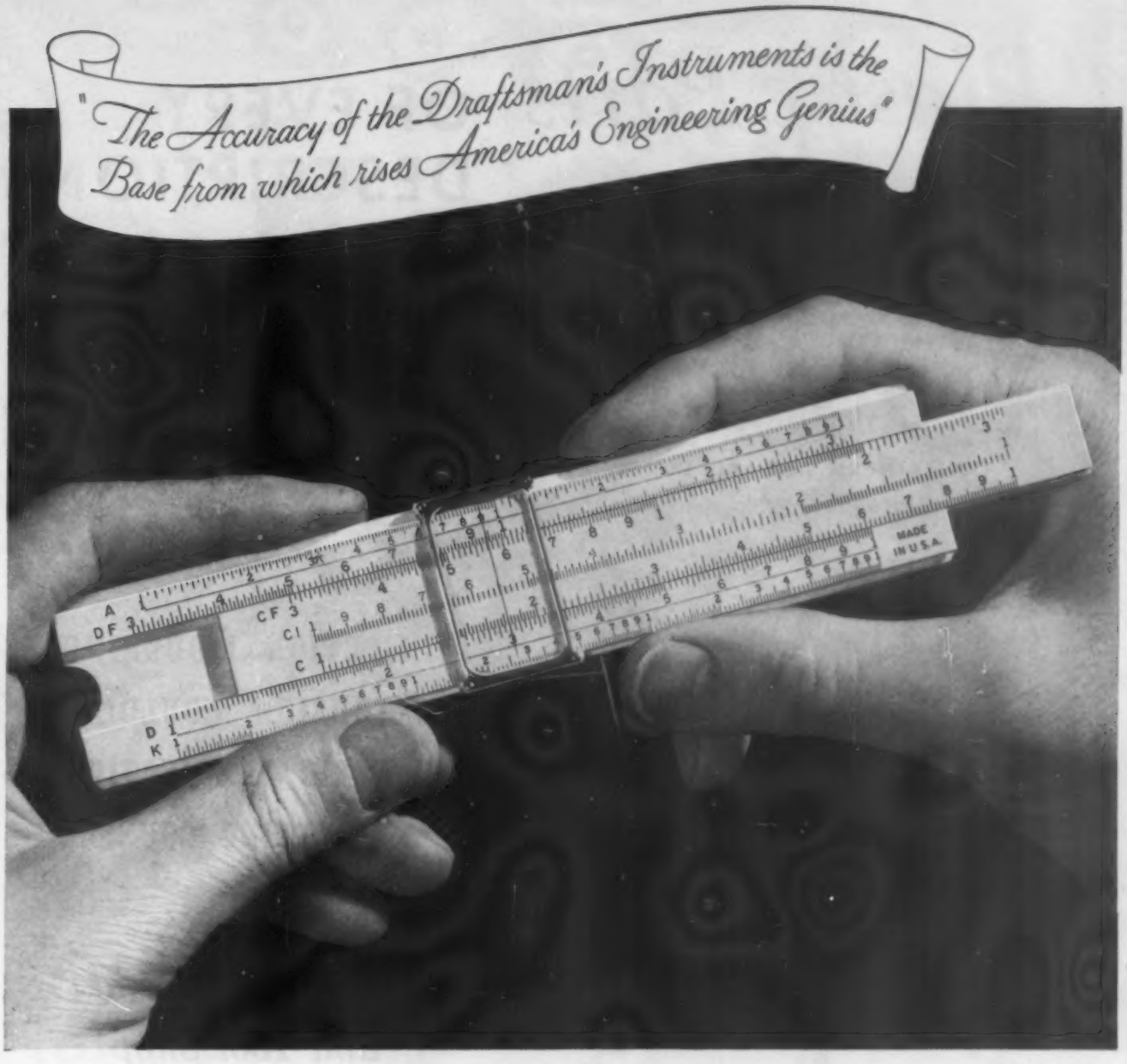
PLASTIC MANUFACTURERS

INCORPORATED

STAMFORD, CONNECTICUT

INJECTION, TRANSFER & COMPRESSION MOLDING • COMPLETE ASSEMBLY

Representatives: NEW YORK CITY—19 West 34th Street • DETROIT, MICH.—805 New Center Building
CAMBRIDGE, OHIO—633 Upland Road • LOS ANGELES, CAL.—1440 S. Robertson Blvd.
WASHINGTON, D. C.—4643 MacArthur Blvd., N.W. • CANADA—David C. Orrock & Co., 1405 Bishop St., Montreal



MANY SLIDE RULES AND MEASURING SCALES ARE MADE OF DU PONT "PYRALIN"

THE MAKERS of high-grade slide rules and other accurate draftsmen's instruments spare no effort to insure optimum performance. They use materials of high quality that last a lifetime of ordinary service.

To provide rules with the greatest accuracy and legibility, manufacturers of the slide rule shown above cut the fine graduations by the precisely engineered method called "engine dividing"... and for clear contrast with an opaque, white background and for dimensional stability besides, the material of which they make them is Du Pont "Pyralin".

"Pyralin" cellulose nitrate plastic has low water absorption... is easy to form... is produced in a wide range of colors. Its use in engineers' and draftsmen's instruments is but one of the wide variety of tasks in which Du Pont plastics are helping to make products last longer, work better, sell better. For information write E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 366, Arlington, N. J.

DU PONT
Plastics
BETTER THINGS FOR BETTER LIVING THROUGH CHEMISTRY

PLASTICS PREVENT "HOT FOOT" ON THIS *ALUMINUM* TABLE RANGE!

Aluminum-plastic teamwork scores again!

When Camco Products, Inc., wanted good appearance, lightness, and easy cleanability in this new "Cloverleaf" table range, Alcoa Aluminum was elected. But aluminum is a famous *conductor* of heat. How, then, could Camco prevent "hot foot" that might damage gleaming dining tables?

The answer is another good example of teamwork between these two modern materials. "Why not plastic feet on the aluminum legs?" asked Camco, taking advantage of the excellent insulating properties of molded phenolics. And there they are, one of the big selling points of this attractive electric appliance.

Aluminum is corrosion-resistant . . . light in weight, like plastics . . . easily fabricated . . . Alcoa Aluminum matches so many of plastics' properties point for point that teamwork is perfectly natural. An Alcoa engineer is ready to help you use it profitably, with the largest fund of aluminum experience in the world.

ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in principal cities.

BEST FRIEND IN METALS

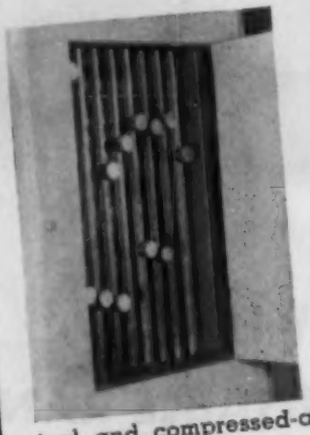
ALCOA FIRST IN ALUMINUM

STOKES MOLDING IS *Really Automatic*

because

The Piece Operates the Press

The exclusive principle of having the piece operate the press means that Stokes Automatic Molding Machines are completely automatic. All moldings must pass through a sensitive trap. Should a piece fail to eject for any reason, should any irregularity in the molding cycle occur, this trap stops the machine and a warning bell automatically attracts the operator's attention.



OTHER FEATURES that mean 100% AUTOMATIC OPERATION

The Stokes Automatic Cycle Controller, easily reset to provide quick changeover from job to job, controls all functions of the machine—feeding, closing, breathing, curing, opening, ejection, mold cleaning. The powder measuring and feeding mechanism is micrometer-adjusted and automatically controlled. An automatic push-off combines mechanical and compressed-air action to eject pieces and clean the mold.

Stokes Model 235 50-Ton Automatic Molding Press. Covered by U. S. and foreign patents.

AUTOMATIC MOLDING is foolproof, flexible, economical

The above and other Stokes developments provide molding presses that are reliable, foolproof, economical. An unskilled man can run a battery of them. These machines are producing a wide variety of parts, in hundreds of shapes and sizes, for such diverse products as electrical, home and office appliances, radio and electrical equipment, automotive accessories, toys, novelties, many others.

Parts produced automatically are identical, low in flash loss, accurate in dimensions, of highest quality. Investigate Automatic Molding.

F. J. STOKES MACHINE COMPANY
5934 Tabor Road, Philadelphia 20, Penna.

F.J.Stokes MOLDING EQUIPMENT FJS Est. 1895

Firestone

*Velon**

Can Make your Product Better

Here you see two of the many uses of *Velon*, the amazingly adaptable new material developed by Firestone research.

As a film, *Velon* can be tailor-made to give two-way "valvular" action—breathing air in, keeping water out. Or it can package delicate, quick-spoiling foods to *keep in* every drop of juiciness, *seal out* flavor-robbing air. *Velon* film never becomes "tacky" in hot weather or brittle in cold.

As a coating or unsupported film, *Velon*'s applications range from protective packaging to rainwear, bags, artificial flowers, book cover stock, lamp shades, cable covering. It can be endowed with any required thickness and tensile strength. It can have very high (or where desired, very low) tear resistance. It can be elastic or capable of great elongation with practically no recovery. *Velon* films can be transparent, translucent, opaque, clear or colored.

Firestone engineers and technicians will be glad to consult with yours. They will show you how *Velon* can effect great economies for you. Write Firestone, Akron, for your free full color *Velon* booklet.

BEST TODAY... STILL BETTER TOMORROW

LISTEN TO THE VOICE OF FIRESTONE MONDAY EVENINGS OVER NBC

*TRADE MARK

VELON FILM

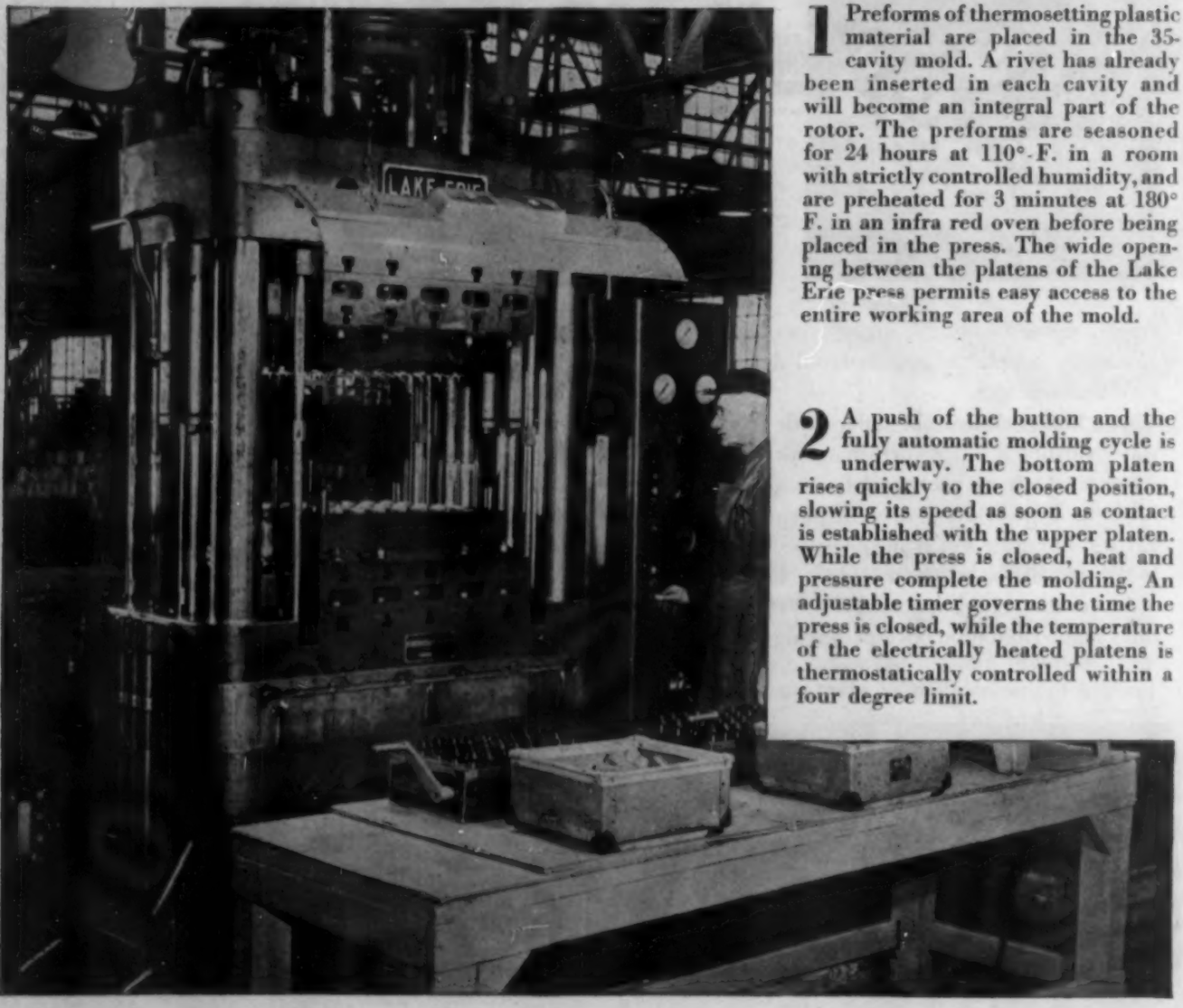
VELON FABRIC

VELON SCREENING

LEATHER-LIKE VELON

How the Ford Motor Company

Rotors are turned out at the rate of more than 150 per hour on this 300-ton automatic Lake Erie Hydraulic Press at the Rouge Plant.



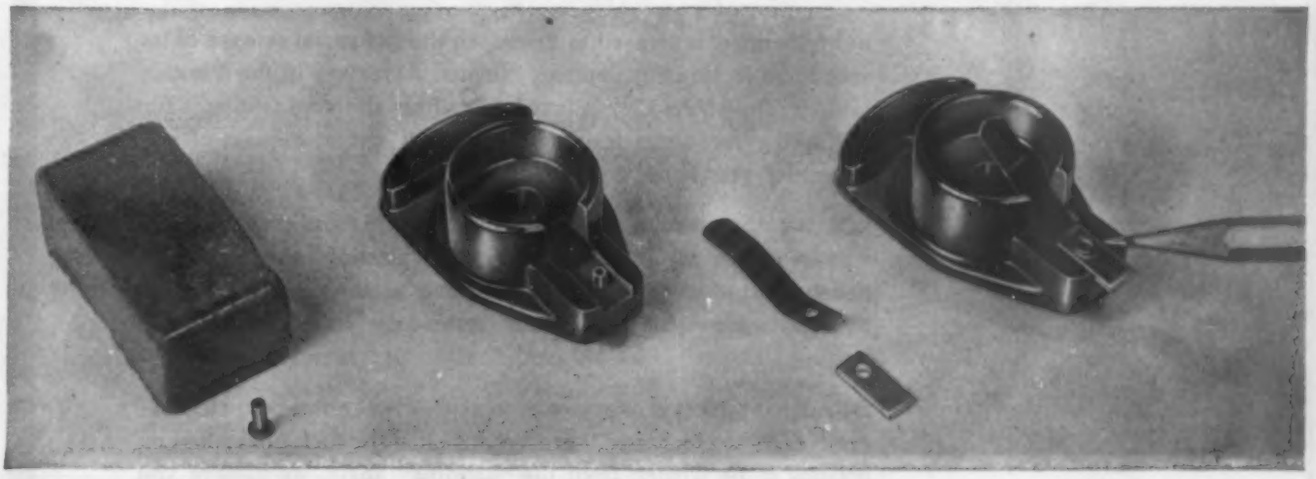
1 Preforms of thermosetting plastic material are placed in the 35-cavity mold. A rivet has already been inserted in each cavity and will become an integral part of the rotor. The preforms are seasoned for 24 hours at 110° F. in a room with strictly controlled humidity, and are preheated for 3 minutes at 180° F. in an infra red oven before being placed in the press. The wide opening between the platens of the Lake Erie press permits easy access to the entire working area of the mold.

2 A push of the button and the fully automatic molding cycle is underway. The bottom platen rises quickly to the closed position, slowing its speed as soon as contact is established with the upper platen. While the press is closed, heat and pressure complete the molding. An adjustable timer governs the time the press is closed, while the temperature of the electrically heated platens is thermostatically controlled within a four degree limit.

produces Distributor Rotors...

3 When the molding cycle is completed—the press is closed for 5 minutes at 300° F.—the Lake Erie Press automatically opens to its full width. The operator then removes the molded rotors and flash or excess material. Within 2 minutes after the molded rotors are removed from the Lake Erie press, they are placed in the ingenious cooling fixture shown in 4.

4 The rods on which the rotors are being mounted are exact duplicates of the rods on which the rotors will be assembled in the distributor. In cooling to room temperature, the rotors shrink onto the rods and are held to within 2/10,000 of an inch of the exact fit required for installation in the Ford engine. A turn of the crank strips the cooled rotors from the rods.



Various stages in the manufacture of Ford rotors. At the left is the preform of thermosetting plastic material and the rivet which is integrally molded in the rotor. Next is the molded rotor with steel spring and brass tongue ready for assembly. At the right is the completed rotor. The pencil gives an idea of the small size of the parts and the need for precision presses and molds in manufacturing this vital Ford part.

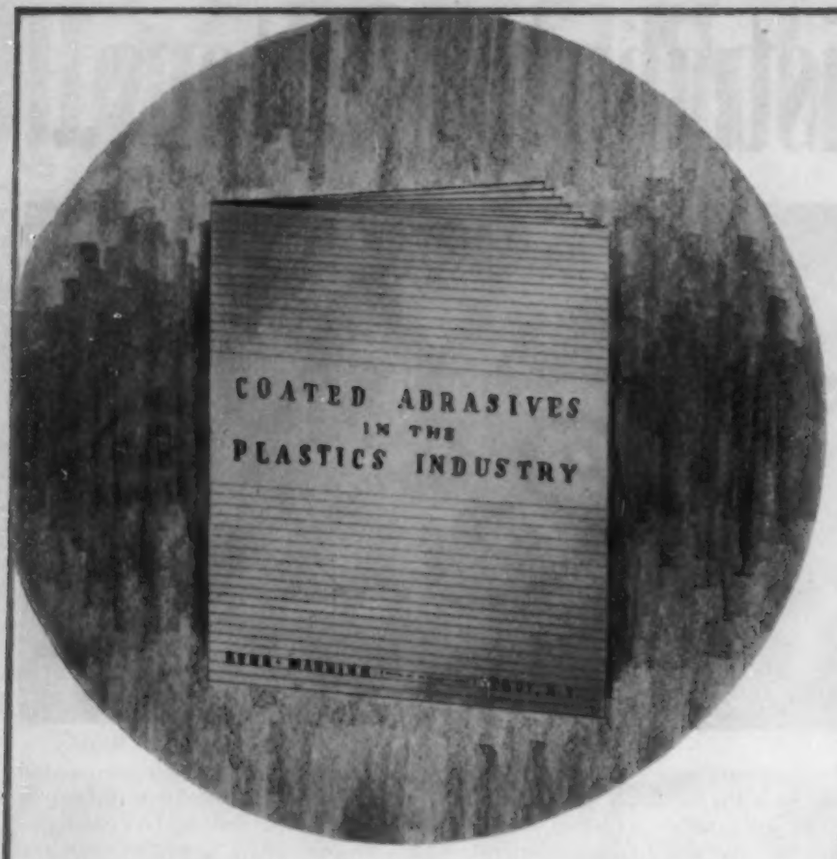
● *Lake Erie Hydraulic Molding Presses, Laboratory and Test Presses are fully illustrated and described in Bulletin 544 just off the press. Write for a copy of this latest information today.*

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE
ENGINEERING CORPORATION
868 Woodward Ave., Buffalo 17, N. Y.

Offices in Principal Cities and Foreign Countries

Leading manufacturer of hydraulic presses ... all sizes and types ... plastic molding ... metal working ... processing ... rubber vulcanizing ... stereotyping ... special purpose.



HOW TO SAND PLASTICS

Behr-Manning is pleased to announce the industrial release of its vocational lecture supplement, "Coated Abrasives in the Plastics Industry," reprinted for industrial use from the original plates for our spring vocational training release, by special request of our industrial service organization.

"Coated Abrasives in the Plastics Industry" is a non-commercial treatise on sanding and finishing all of the plastics—with a comprehensive introduction to the plastics, their names, families, properties and uses—plus a 17″ x 22″ three-color reference chart for posting.

Because it strikes a happy compromise between the "too elementary" and "too technical," and because it is the first publication on plastics to be written from the "sanding" angle, we believe you will enjoy and use "Coated Abrasives in the Plastics Industry." There is no charge or obligation. Merely reserve your copy by writing us, attention Educational Service Department.

BEHR-MANNING

(DIVISION OF NORTON COMPANY)

TROY, N. Y.

QUALITY COATED ABRASIVES SINCE 1872

A TIMELY TIP TO PACKAGE DESIGNERS...

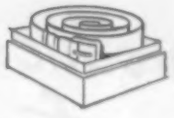
plastic containers that display as well as protect their contents

HERE IS literally an open-and-shut case for the cellulosics—a sales inspiration for display-minded package designers.

Molded by Braun-Crystal Mfg. Co. from cellulose acetate, this watch container serves a dual purpose. When opened, it makes an eye-compelling display. When closed, it safeguards the watch from dust and damage.

Once again, the colorability, translucency, toughness, moldability, dimensional stability, and economy of the cellulosics combine to produce an unusually effective package which otherwise would have been impossible or costly.

The unique properties of the cellulosics make them the ideal packaging materials for products ranging from cosmetics to hardware. Send for descriptive folder.



Cellulose acetate boxes do double duty in the home after products are used

Transparent acetate protects pens on display or when not in use

Cellulose plastics provide colorful display-use stands for cosmetics, perfumes

HERCULES

CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

For general-purpose production plastics

Hercules does not make plastics or molding powder, but supplies the high-quality cellulose derivatives from which they are made. For data, please write to

HERCULES POWDER COMPANY INCORPORATED 916 Market Street, Wilmington 99, Delaware

6P-67

Mass production plating of small items gets Results!

The mass production era has come to the Plastics Plating Industry! A new exclusive process developed by Plastiplate, has removed the plating of plastics from the tailor-made brackets and placed it into the mass field. Decorative effects, previously impossible except at prohibitive rates are now available at low cost.

Plastiplate CO., INC.

SOUTH RIVER • NEW JERSEY

Our laboratory and engineering staff have the answer to your plating problem. We invite your inquiry

Bernard F. Walker
President

MASS PRODUCTION AT LOW COST

Here's Economy *plus* Precision

FOR YOUR SMALL SECTION, CLOSE TOLERANCE WORK

THE addition of a 1½" National Extruder to your present units will equip you for the most economical production of small sized sections to close tolerances. Capacity is approximately 30 lbs. per hour.

Principal advantages of producing a single extrusion on smaller equipment instead of multiple extrusions on a larger extruder are these:

1. Closer tolerances and greater uniformity are possible.
2. More accurate control of plasticizing and extruding temperatures can be maintained.
3. Operating costs are lower. Smaller machine, less space, less heat, less power, less scrap . . . all add up to saving money for you.
4. Larger machines are released for heavier work and the higher production they are designed for, resulting in more profitable overall operation.

Your order *now*, will place you in a favorable position for delivery. Write for our new catalog section describing the 1½", and other types of plastics extrusion equipment for every requirement.

NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION

Electrical Test ASTM Dielectric Strength @ High Voltage Transfer.

Physical Tests Universal Test of Tensile Evaluation.

Optical Test Evaluating Stress concentrations with the aid of a polariscope.

TRAINING
in step with
INDUSTRIAL TRENDS

Plastics Institute training is predicated on two basic principles: A. Thorough study of accepted practices and materials. B. Evaluation of current problems, new materials and new techniques. Standard ASTM Test Methods form an important phase of the Plastics Institute Training Program.

In addition to testing, other phases of plastics thoroughly covered at Plastics Institute include: Materials, casting, mold design, molding, fabricating and laminating. Industry type equipment is used in the classrooms.

Your inquiries regarding the Resident, Home Training and Study Form Courses are welcomed.

Write Dept. MP6-6

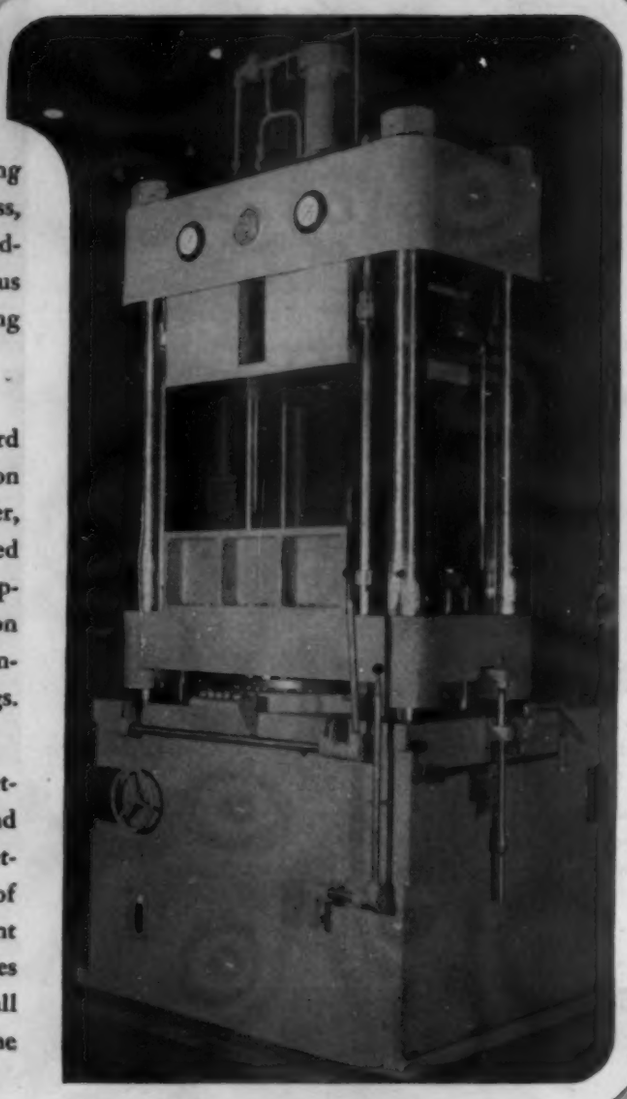
VETERANS as well as civilians now training with Plastics Institute, upon graduation, are qualified and worthy of your consideration for employment in the various branches of the plastics industry. Write to the nearest branch of Plastics Institute stating your requirements. We will endeavor to select a graduate best qualified to meet your needs.

Plastics
INDUSTRIES TECHNICAL
INSTITUTE

Francis A. Gudger, President - John Delmonte, Technical Director

NEW YORK - 122 EAST 42ND ST. ★ CHICAGO - 221 NORTH LASALLE ST. ★ LOS ANGELES - 1601 SOUTH WESTERN AVE.

VERSATILE TRANSFER MOLDING PRESS



The Hydraulic Press Manufacturing Company's excellent Transfer press, shown in the illustration, enables molders to benefit from the tremendous advantages of the Transfer molding process.

Equipped with a 300 ton upward acting clamping ram and a 75 ton downward acting Transfer cylinder, this versatile press will produce molded parts economically on very fast operating cycles. The variable control on the Transfer ram permits close dimensional regulation for precision moldings.

In addition to producing thermosetting plastic parts economically and quickly, Transfer molding imparts better appearance and uniform strength of products. Molders will get excellent results in the manufacture of articles with delicate metal inserts, thin wall sections or long thin holes, by using the Transfer process.

SHAW

SHAW INSULATOR COMPANY

160 COIT STREET — QUALITY MARK ON MOLDED PLASTICS — IRVINGTON 11, N. J.

PLASTICS LITERATURE AVAILABLE

When your production plans call for thermosetting plastics, the logical first move is to consider Transfer molding. A list of licensed Transfer molding companies in your vicinity will be furnished promptly upon receipt of your request. Choose one—and allow him to work closely with your engineers and designers for best results.

To learn more about the specific advantages of Transfer molding, write Shaw. Engineering help in the form of bulletins and technical articles will be gladly sent you. Between the resources of Shaw and the Plax Corporation, Hartford 5, Conn., you can obtain assistance in almost all plastic methods and materials.

LOOKING FOR SOMETHING UNUSUAL IN PLASTICS?

A glance at these photographs, which show a few of the plastic forms available from Plax, may indicate to you that Plax is a good source of unusual things, some of which are original Plax developments.

From dress decorations to high frequency electronic applications, Plax products are daily proving themselves in a wide variety of industries. In many cases, Plax engineers assisted in the selection of the proper material and Plax experimental and development laboratories have been instrumental in making a practical reality out of a design engineer's desires.

For illustrated literature on properties, prices and application suggestions for Plax plastic products, please write Plax.

PLAX SPECIALTIES

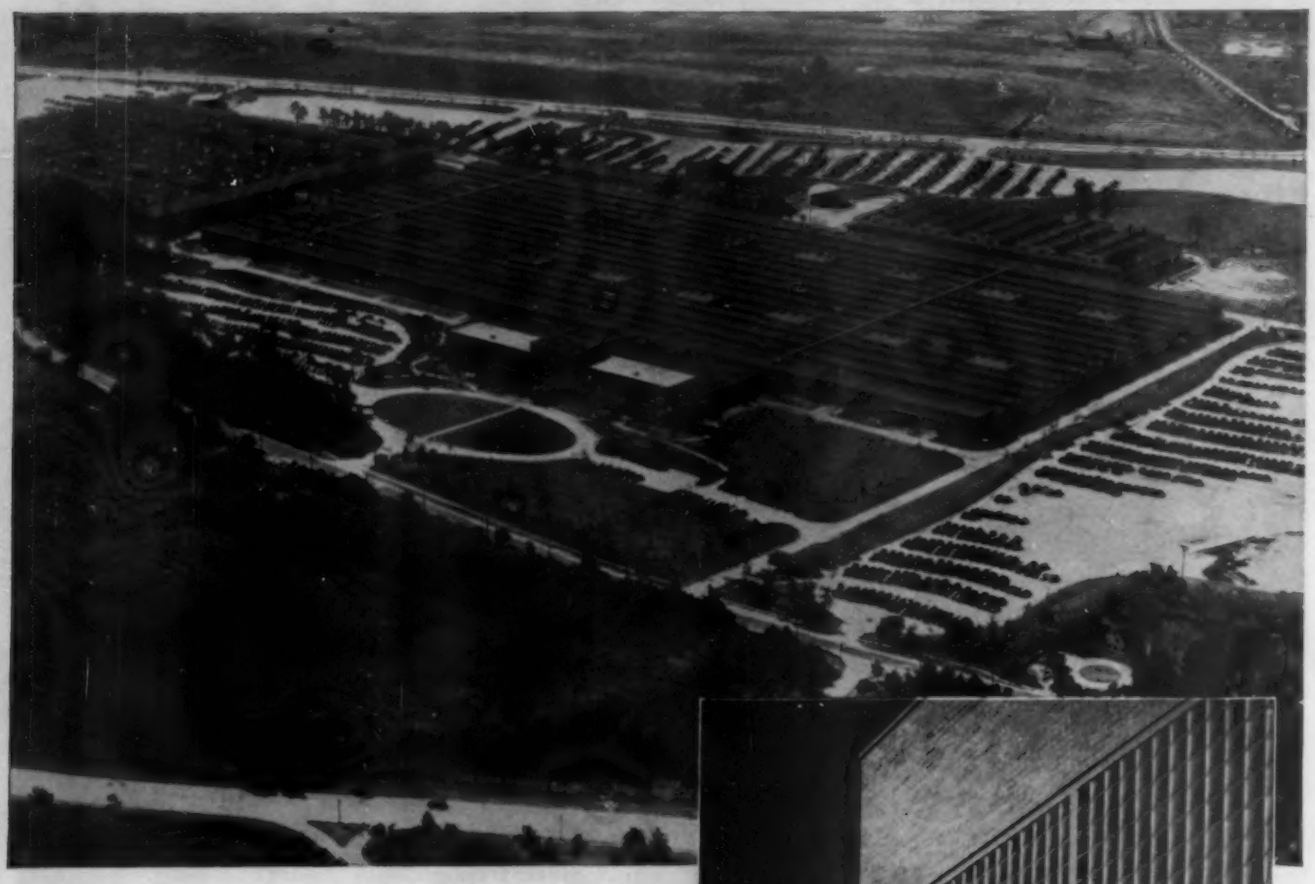
Polystyrene, Polyethylene, Methacrylate, Ethyl Cellulose, Cellulose Acetate, and Cellulose Acetate Butyrate are among the materials Plax produces in the following forms: Rod, Tube, Sheet, Slab, Film, Fiber, Special Extruded Shapes, Blown Items, and Machined Parts. Not all materials are available in all forms listed.

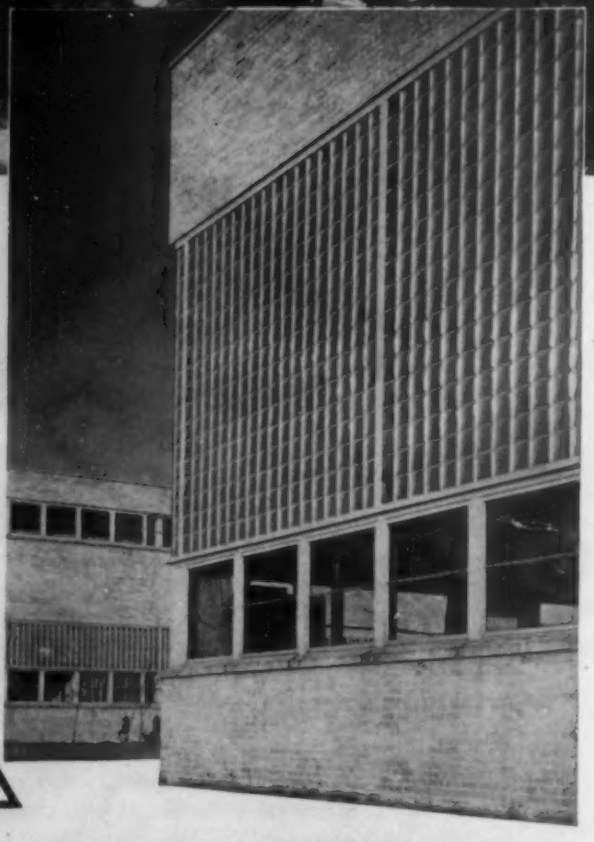
Between the resources of Plax and the Shaw Insulator Company, Irvington 11, N. J., you can obtain help and counsel in the use of most plastic materials and processes. For interesting literature on the materials listed above . . . write Plax.

PLAX
FOR PLASTICS
NOT SUBSTITUTES···IMPROVEMENTS

133 WALNUT STREET ★ HARTFORD 5, CONNECTICUT

WHERE THE BOMBSIGHTS GREW





Utility and beauty are combined in the Nassau Plant where bombsights and other vital war precision instruments and equipment were manufactured by Sperry Gyroscope Co., Inc. The plant is modern and functional in design to assure maximum efficiency and comfortable working conditions.

Designed and built by Stone & Webster Engineering Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

PLAN TO USE PLASTICS

A few of the parts being molded by Aico for the new Edison Electronic Voicewriter Thomas A. Edison, Incorporated West Orange, New Jersey

EDISON engineers utilized the properties of plastics to their greatest advantage when designing the new Edison Electronic Voicewriter. Exterior parts were molded in a harmonizing color with a smooth, satiny finish. Interior parts were molded from materials chosen for dimensional stability and economical production.

Edison not only stylized the Voicewriter but they simplified its production by *planning to use plastics.* They placed the order for twenty-two separate parts with one company . . . AICO. Because AICO has been molding precision plastic parts from all materials using all methods for thirty years, Edison entrusted AICO with the job of using the one material and one method best suited to each individual part. Let AICO's thirty years of molding experience help you with your *plan to use plastics.* A request on your letterhead will bring our new book . . . *"Aico Plastics from Your Point of View."*

PRECISION MOLDING

AMERICAN INSULATOR CORPORATION

NEW FREEDOM, PA.

SALES OFFICES:
Cleveland • Detroit • New York • Philadelphia

Sales Appeal Plus in Plastics by Pyro

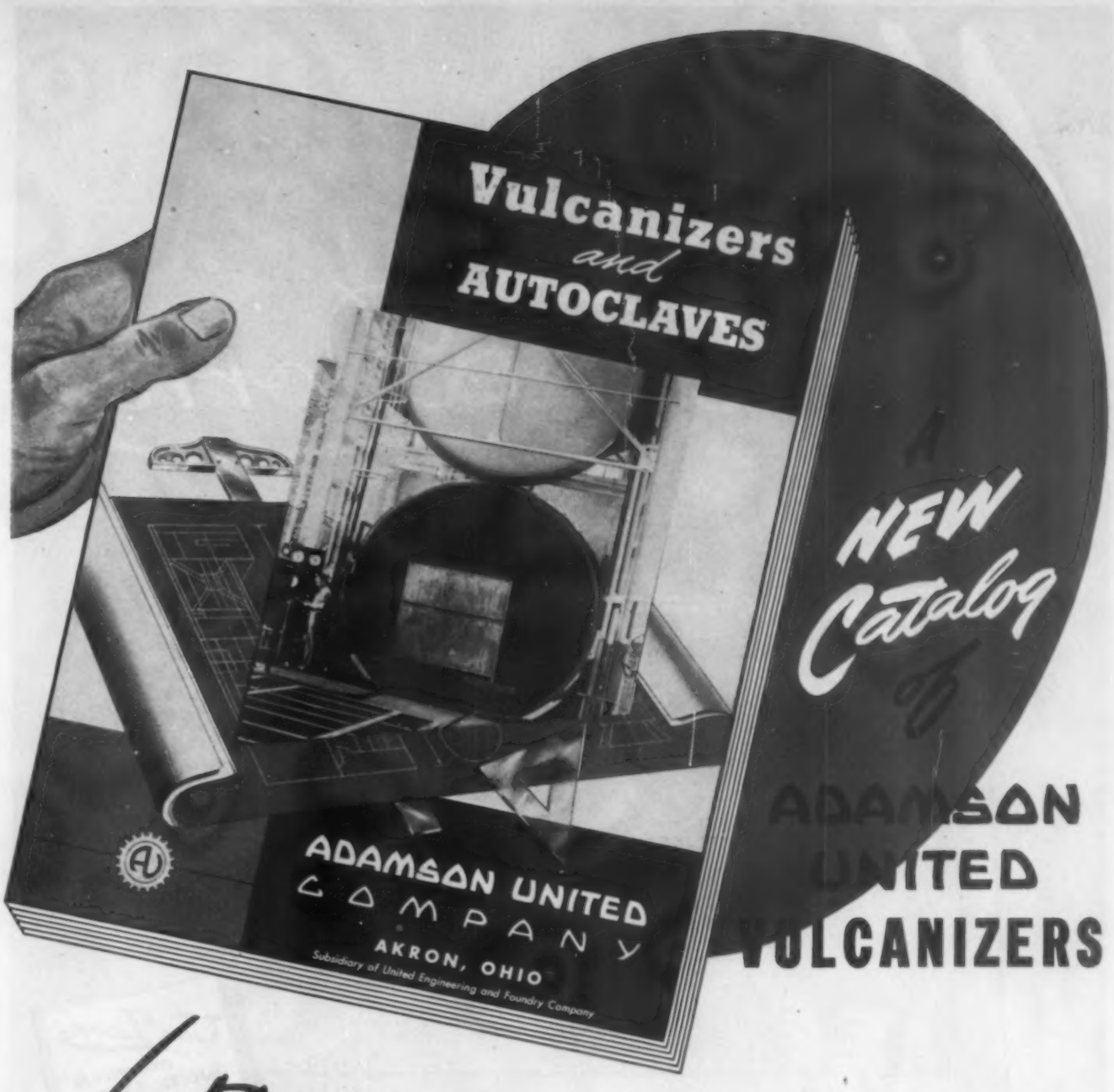
Among the many glamorous products produced by the plastics industry are those molded by Pyro Plastics Corporation.

Products which add beauty and comfort to a home . . . products which amuse and instruct . . . products which save time and effort . . . these are the types of plastic products in which PYRO specializes.

If you have an idea which might have merchandising value if molded in plastics . . . or if you want some engineering advice in regard to a product already developed in plastics . . . feel free to call on us.

PYRO PLASTICS CORPORATION

WESTFIELD • NEW JERSEY



Send for OUR COPY TODAY

It illustrates and describes the principal types of vulcanizers and autoclaves developed and manufactured by Adamson United and successfully used by leading rubber companies here and abroad. Its pages reveal the wide scope of Adamson United designs and the vast range of sizes of equipment available to the industry. Whether for present information or as a source of future reference, this new catalog will prove valuable for the information it contains and as an outline of Adamson United vulcanizing equipment installed and in commercial operation throughout the world.

Write for a copy on your company letterhead. The edition is limited, so don't delay!

ADAMSON UNITED COMPANY engineers will gladly cooperate with you on all your technical problems and supply all possible data and information. Our abilities, experience and extensive manufacturing facilities are at the service of the industry.

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AKRON 4, OHIO

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Bloomfield Bank & Trust Building, Bloomfield, N. J.
Telephone: Bloomfield 2-4143
140 South Clarke Street, Chicago 3, Illinois
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SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY
Plants at Pittsburgh, Vandergrift, New Castle, Youngstown, Canton

All type H blocks are 2" wide; all type S blocks are 2½" wide.

Stock Mold Terminal Blocks

Standardized, stock-mold terminal blocks to serve all industries quickly and efficiently are in steady production at Insulation Manufacturing Company's plant.

Type H (Bakelite) comes in four sizes: 4, 6, 8, and 12 terminals. The 6 terminal block is illustrated. It is available with copper grounding strip, plastic covers and white marking strip.

Type S (Shellac) comes in three sizes: 4, 8, 12 terminals only.

These blocks are standard circuit connectors in many industries. The molds are ready-made and can be put on presses to deliver any quantity.

In addition to manufacturing Stock Mold Terminal Blocks, we offer our molding facilities to all industries for making custom Terminal Blocks as well. We manufacture these electrical items for a number of large companies in all fields.

INSULATION MANUFACTURING CO.

CUSTOM MOLDERS OF PLASTICS FOR INDUSTRY

11 New York Avenue • Brooklyn 16, New York

NE 8-6633

Troublesome Parts?

NOT WHEN FABRICATED BY PANELYTE

Many customers visiting our new Fabricating Plant for the first time are impressed by the ample facilities for all types of fabrication, particularly . . . Milling. A few representative pieces depicting milling as one of the fabricating operations are pictured below.

It may be that a troublesome part in your own production could be better designed in Panelyte. Irregular contours or angles can be successfully milled to the degree of accuracy and uniformity necessary for interchangeability.

Use Panelyte Service to improve your product or simplify its assembly . . . to save weight . . . to speed production.

Your inquiry is invited on any problem involving the use of structural, laminated resinous plastics.

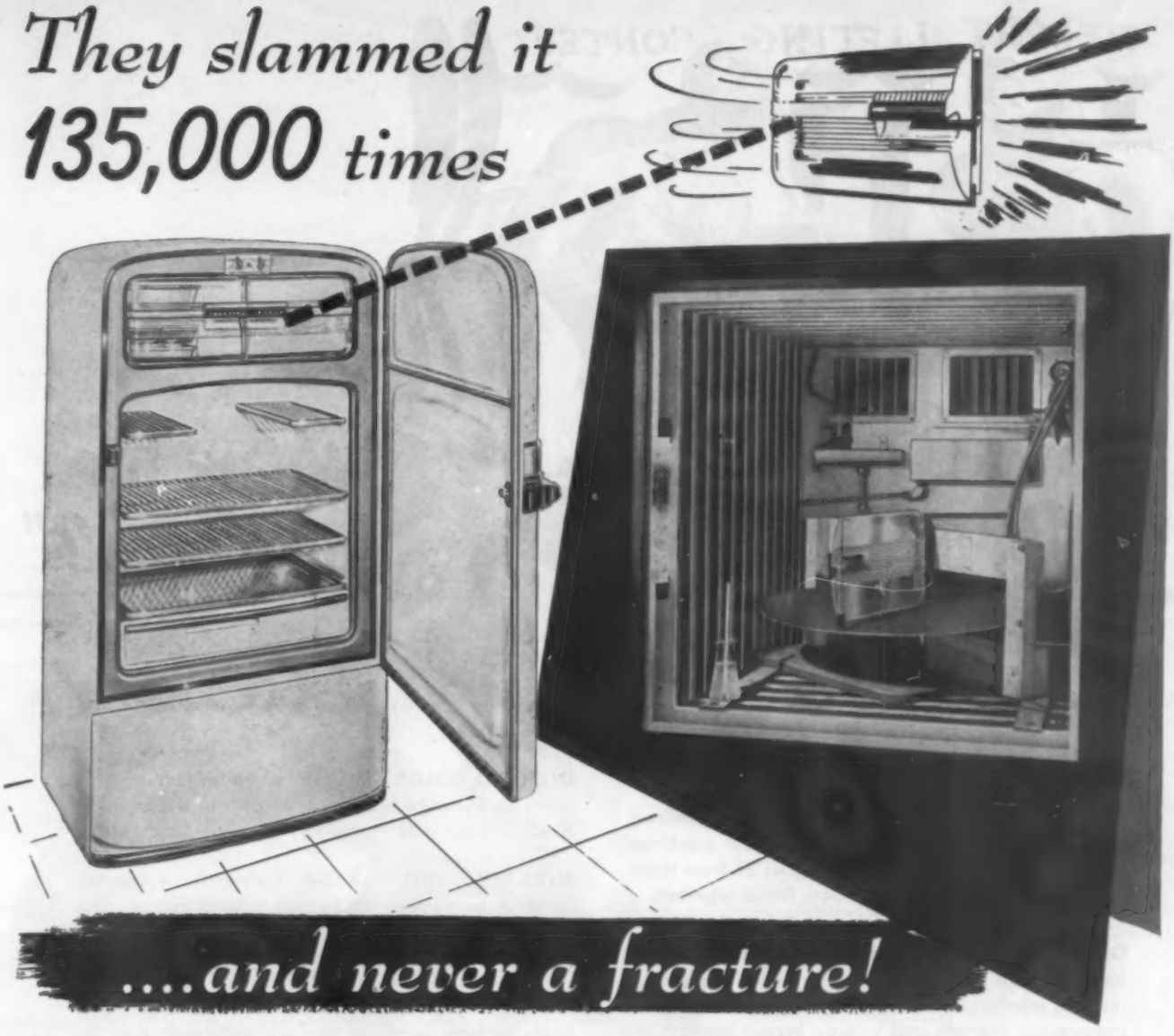
PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Lookout Mt., Tenn., New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Trenton: Buenos Aires, Johannesburg, Mexico City, Montreal, San Jose, Sao Paulo, Sydney, Toronto, Vancouver.

MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, ASBESTOS BASE LAMINATES; DECORATIVE GRADES

They slammed it 135,000 times



....and never a fracture!

When it comes to thoroughness . . . an unyielding insistence upon quality in their products . . . you have to take your hats off to Admiral Corporation of Chicago, manufacturers of Admiral Dual-Temp Refrigerators. Here's an example of what we mean:

"Specs" called for a pair of transparent doors for the frozen food compartment of the refrigerator. It was a natural for plastics and the job was entrusted to CMPC. A transparent polystyrene material was selected, molds were built, and a test run made by injection molding.

Then Admiral engineers wanted to know how these doors would stand up under actual use. Would extreme cold make them frangible? Would continued use weaken them? They designed and built an automatic "door slammer" which snapped the door shut 22 times per minute. At room temperature they slammed it 85,000 times with no sign of fracture. And since normal use of the door is approximately 15 times per day, this test is equivalent to 15 years of use.

Following this, another test was made . . . 50,000 "slams" of a door in a cold chamber at temperatures from 5° above to 10° below zero F. Again no fracture. We believe these tests are rather conclusive, and certainly indicative of Admiral's desire to insure satisfactory operation far beyond the requirements of normal use.

CHICAGO MOLDED PRODUCTS CORPORATION

We like to work with customers like Admiral . . . those whose ideals coincide with ours . . . who insist upon quality, dependability, and long life in everything they build. That's one reason why so many manufacturers come to CMPC for molded plastics . . . why you, too, will find it worthwhile to discuss your plans with a CMPC Development Engineer.

1046 N. Kolmar Ave. Chicago 51, Illinois

Representatives in principal industrial centers

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

"What's he doing here?"

There's surprising strength in Shorty's streamlined structure. Makes you think of KYS-ITE. *It* combines great strength with lightness. And goes on from there to offer additional features seldom found together.

GREAT STRENGTH WITH LIGHT WEIGHT — Preformed before curing, an even distribution of phenolic resin on interlocking fibres results in great tensile and compressive strength and with an impact strength up to 5 times that of ordinary plastics.

WIDE RANGE OF SHAPES—Complicated pieces with projections and depressions, large or small shapes and sections—all these and more, too, are molded successfully in KYS-ITE.

***KYS-ITE* CAN "TAKE IT"**—Unusually durable and resistant to abrasion, impervious to mild alkali and acid solutions.

INTEGRAL COLOR—KYS-ITE's lustrous finish is highly durable; the color is an integral part of the material itself. A wipe and it's bright!

NON-CONDUCTOR—KYS-ITE's dielectric properties make it invaluable where safety is a factor. Also a non-conductor of heat. Non-resonant and non-reverberating.

CONTINUING HEAVY DEMAND FOR KYS-ITE prevents us from handling new specialty orders at this time. As manpower and materials become more available, we see this situation improving, however. In the near future we hope we can again offer our complete service on molded plastics problems.

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES
MOLDED PRODUCTS

KYS-ITE articles indicating the range of items we mold to specifications and deliver complete, ready for use.

Preformed Plastic Combining Long- **KYS-ITE** **Fibred Wood Pulp and Synthetic Resin**

*Trademark Reg. U. S. Pat. Off.

The plastic fabric

FOR "COVERAGE"

AGAINST ACCIDENTS

It's an off day for Johnny. All dressed up to go places and see what happens! But Johnny needn't worry! Bus seats and luggage made of Saran*, a Dow plastic, keep smiling in spite of kicks and scuffing and boys with ice cream cones.

You can see that Johnny's mother is only mildly disturbed. She knows accidents happen. But she knows, too, that fabrics of Saran—in handbags, luggage and rugged transportation seating—can be cleaned bright as new with a damp cloth. She knows that Saran provides good "coverage" against accidents!

Fine strands of Saran are weaving beauty that's almost indestructible. Saran's bright colors last because each strand has color all the way through. And Saran's colors are sunfast. Furthermore, the smooth, pliant surfaces of Saran fabrics won't absorb dirt. They won't stain or become discolored. They're unaffected by most chemicals, even acids.

You can look to Saran for fabrics that eliminate drudgery and meticulous care. You can count on Saran (as many textile producers are!) for fabrics with a long and colorful career.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
Los Angeles • Seattle

*Pronounced Sah-*ran*.

SARAN

FOR BEAUTY AND WEAR IN TEXTILES

Saran textile monofilaments are produced by Dow-approved fabricators. (Dow makes only the basic plastic material.) Saran also is used for rustproof screen cloth, chemical-resistant pipe and tubing and film for protective packaging. Dow also produces Styron, for brilliant lighting fixtures, costume jewelry and cosmetic containers; Ethocel, for radio cabinets, telephones and other durable molded products; Ethocel Sheeting for flexible containers; and special materials for coatings and finishes.

Dow Plastics include: ***Styron, Saran, Saran Film, Ethocel and Ethocel Sheeting***

DOW

PLASTICS

BASIC MATERIALS FOR FINER PRODUCTS

for immediate sale

GOVERNMENT-OWNED SURPLUS

HEAT TREATING FURNACES

Standard Makes · Modern Equipment · Attractively Priced

Here is real opportunity to complete plans tabled because of equipment shortages. Hundreds of surplus industrial furnaces, from melting types to induction hardeners, from simple dryers to the last word in controlled atmosphere heat treating furnaces are available now . . . in quantity . . . for immediate application to production line, tool room, or laboratory problems. Here, priced for quick sale, is exactly the equipment you have been waiting for to improve post war products or cut fabricating costs.

This equipment is now on sale at every War Assets Administration Regional Office. Check into it today.

CONTROLLED ATMOSPHERE HARDENERS

For precision tools and dies and applications where surfaces must be protected.

VETERANS OF WORLD WAR II: To aid you in purchasing surplus property, a veterans' unit has been established in each War Assets Administration Regional Office.

INDUCTION HARDENERS

The latest development in controlled surface hardening by high frequency induction.

THREE STEPS TO TAKE

1. **Accurately Determine Your Needs**—Check your operations and jot down the type of equipment you need, necessary capacities, ratings, etc. Where possible indicate the make of equipment you would prefer. This information we will need to locate for you suitable surplus equipment.

2. **Estimate the Cost You Can Afford**—Here again is a guide we will need in locating the right equipment for you among the many hundreds of available furnaces. In pricing we give consideration to such alterations as may be necessary to meet your specific problems.

3. ***FILL IN AND MAIL THIS COUPON***

To War Assets Administration: Please send me information on the following types of Surplus Heat Treating Equipment:

FUEL	INTENDED USE	TYPE OR MAKE
☐ Electrical	.....	.....
☐ Gas	.....	.....
☐ Oil	.....	.....
☐ High Frequency Induction	.....	.....

I am also interested in ☐ heating furnaces, ☐ melting furnaces, ☐ dryers, ☐ kilns.

Name..... *Tel. No.*.....

Firm.....

Address.....

City..... *State*..... 174-2

WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

Why Hard Rubber for *Knife Handles?*

The reasons why so many cutlery manufacturers use hard rubber may lead you to the solution of one of your design or production problems.

AMONG the advantages of these attractive hard rubber knife handles is their easy assembly into permanent units. Hard rubber has thermoplastic tendencies when heated through, but is a hard, strong solid at ordinary temperatures. Thus, the heat-softened rubber readily closes around metal inserts or cores—such as the tang of a knife or tool handle—and shrinks tightly to the metal as the assembly cools. Because rubber is a permanent plastic with good machining qualities, assembly by riveting also produces an enduring unit.

Hard rubber has a pleasant, sure feel in the hand of the user. It holds its shape in water because rubber is the most nearly waterproof of all the plastics. A hard rubber knife handle has, in addition, high resistance to alkalies and to hot soap solutions. It completely ignores the softening inroads of fats and oils.

So far none of the newer plastics has the overall properties needed for applications like this. However, since we have research and manufacturing facilities for both rubber and the other plastics, our laboratories test new developments in each. Thus, we are always in a position to give our customers better materials as they appear.

We manufacture an extensive line of hard rubber knife handles to meet the needs of cutlery manufacturers. Special designs can be made up and executed whenever volume warrants the design and mold costs.

Do you need a lot of something *like* a knife handle?

If you are planning a product that approximates these handles in size, shape, physical and chemical requirements...or something which may gain added appeal from that certain satisfying "heft" and "feel" of hard rubber...chances are that our experience and facilities for efficient large volume production will enable us to fill your needs at reasonable cost.

Might be worth exploring.

VULCANIZED RUBBER AND PLASTICS COMPANY

formerly . . . The Vulcanized Rubber Company

Manufacturers of Rubber and Molders of Plastics

General Offices: 4 East 29th Street, New York 16, New York Works: Morrisville, Pa.

A BIG NAME in small plastics

Owens-Illinois closures are highly praised by an extensive list of satisfied users because of their strength, their uniform thread, their accurate side walls and their tight-sealing.

Our high-speed, automatic closure-molding machines are also available for the construction of a wide variety of small thermo-setting plastic units, maintaining the same high standards of efficiency and economy. Write our Plastics Division for further information.

LOOK FOR THE DIAMOND

PLASTICS DIVISION

OWENS-ILLINOIS GLASS COMPANY

TOLEDO 1, OHIO • BRANCHES IN PRINCIPAL CITIES

7 YEARS BAD LUCK !!

NOT WITH *Flexmir's* UNBREAKABLE PLASTIC MIRRORS!

Thru its exclusive metallizing process, Flexmir can MIRRORIZE Plexiglas and Lucite for you in durable, silver, gold and brilliant color finishes. Fabricators! Enhance the beauty and quality of your products! Large mirrored surfaces are available. We invite your inquiries.

Specialists in metallizing acetate lengths in brilliant colors for sequins and decorative uses.

PIONEERS IN METALLIZING PLASTICS

Flexmir INC.

20-28 BROOME STREET NEWARK 3, N. J.

AFFILIATED COMPANIES: PLASTICS FINISHING CO., INC., FLEXMIR DISPLAY CO., INC. METALLIC PLASTICS CO., INC.

BIRDSBORO HYDRAULIC

BIRDSBORO presses for compression molding, transfer molding, sheet curing or laminating offer a range of engineering designs to meet many plastic press requirements. They can be furnished with either straight mannal, automatic single cycle or automatic continuous controls, designed to meet all phases of the required molding cycle. Compression presses can be furnished from standardized designs in sizes from 25 tons to 300 tons and basic designs are available for larger sizes.

Sheet curing or laminating presses can be furnished from available designs in sizes from 140 tons to 5000 tons and larger if required.

In answer to your plastic press problems specify BIRDSBORO presses.

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PA.

BIRDSBORO

HYDRAULIC PLASTIC PRESSES

THE NEW Fibron #5373 FLEXIBLE PLASTIC TUBING

Test Data

Tensile Strength.....3000 P.S.I.
Dielectric Strength (.020" wall) Wet.....1000 VPM
Dry.....1000 VPM
Life at 105° C.....2000 Hrs.
Chemical Resistance (room temperature)
50% Sulfuric Acid and 30% Sodium Hydroxide.....Unaffected
Does not support combustion
Low Temperature Flexibility
I.V.I. Pinch test.....—40°C.
Bell test.....—30°C.
Heat Endurance (.166" ID tubing, .016" wall) ASTM-D350-43T): 7 days @ 125°C.—No crack when bent 180° around ¼" mandrel—Retains flexibility when varnished and baked 22 hours at 260°F.—No flow or drip during 8 hours at 300°F.

This Irvington formulation provides new advantages, new cost-saving features, for many plastic tubing applications. For example: Transformer leads of #5373 remain flexible even after varnishing and baking . . . Underwriters' Laboratories approved #5373 insulation on applications involving continuous operating temperatures up to 75 deg. C. and intermittent temperatures as high as 85 deg. C. In addition, #5373 possesses the excellent electrical, mechanical and chemical properties which distinguish all Fibron tubings.

Tubings of Fibron #5373 are available in all standard colors and sizes, and in heavy wall thicknesses—in 36" lengths, continuous coils, or cut pieces. For full details and generous samples, write Dept. 146 Irvington Varnish and Insulator Co., Irvington 11, New Jersey.

IRVINGTON *Varnish and Insulator Company*
IRVINGTON 11, NEW JERSEY, U.S.A.

HANDLES REQUIRE SKILLFUL HANDLING

EXAMINE these Norton-molded plastic handles closely.

They look as though they were simple to produce, don't they?

Actually jobs of this sort call for great skill on the part of the custom molder. First, he must satisfy strict design requirements which, although primarily functional in nature, call for a handle that blends perfectly with the lines of the finished product. Secondly, the molded handle must meet stringent mechanical requirements such as heat resistance, impact strength and pleasant "feel".

For years, Norton's experienced design engineers have been working closely with progressive, plastic-minded manufacturers representing practically all fields of industry . . . from cosmetics to household appliances.

Combine this rich background of successful product development experience with the extensive facilities for compression and injection molding which are available here and you can easily understand why leading producers everywhere all look to Norton for their custom molding.

Why not send us a detailed description of your plastics problem? Norton Laboratories, Inc., Lockport, N. Y. *Sales Offices: 347 Fifth Avenue, New York City—9 South Clinton St., Chicago.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

NEW!

TURNER

COMPRESSION MOLDING PRESS

- *FULL HYDRAULIC*
- *SELF CONTAINED*
- **EARLY DELIVERY**
- **LOW PRICE**

***THIS** is the press you saw in operation at the plastics show!!* **New in design, absolutely safe and simple in operation. Unusually economical in price and operating costs. Occupies only five square feet of floor space. Every cubic inch *works!* Ready for molding with but one connection to your electrical supply. Thermostatically controlled electric hot plates standard, steam plates optional. Automatic ejectors, hand reset. Molding pressure easily adjustable up to 55 tons. Oil hydraulic system completely sealed against dirt and dust. Easy accessibility for inspection and maintenance.**

MADE IN ENGLAND

by

Turner Mfg. Co., Ltd.,

Wolverhampton

For further information, write our U. S. A. representatives:

H. T. KENNEDY CO., INC.

30 Church Street, New York 7, N. Y.

COrtlandt 7-7654

No "HAND-ME-DOWNS" at MOSINEE

It is the MOSINEE policy to create *custom-made* papers *only* . . . custom-made to fit our *customers' specific requirements.* There are no "stock runs" of general-purpose papers at MOSINEE . . . no "hand-me-downs" or attempts to sell you a standard paper rather than the "made-to-order" type that is essential to the functions you want paper to perform in your products and processing.

MOSINEE paper technicians cooperate in determining *what* you need in paper, and *how* you can process it best . . . then MOSINEE makes paper according to *your* needs. MOSINEE has the experience plus scientific and production controls for moisture repellency, specified dielectric strength, high tensile strength, folding, maximum-minimum pH and other vital characteristics of modern industrial papers.

That's why many manufacturers rely on MOSINEE as a dependable source for industrial papers.

MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

Essential Paper Makers

Please address your letter Attention Dept. A"

In plastic molding

PROPER MOLD MAKING

assures beauty more than surface deep!

Mack MOLDED EXCELLENCE

Poor surface is only one of the major troubles which may ruin an otherwise perfect molding job. These "quirks" are many—ranging from pitting and blisters, to sticking and warping...are brought about by a multitude of conditions.

Microscopic scrutiny would reveal such imperfections penetrating far below the surface or finish, delving into the body of the structure itself. That's why experience goes a long way in plastic molding to obtain proper results . . . with mold making tending toward craftsmanship, rather than a mere mechanical phase.

WRITE FOR THIS INFORMATIVE BROCHURE

MACK MOLDING—With a background of some twenty-six years in serving industry—offers complete collaboration from design and blueprint inception, right through to final delivery. For a better, closer customer-molder understanding of plastic molding and the problems involved, an eight-page booklet is available on request. A general, non-technical treatise, this literature offers helpful hints and possibilities for plastics in your scheme of things. A note on your letterhead will bring your copy promptly.

MACK MOLDING CO., INC.

120 MAIN STREET, WAYNE, NEW JERSEY

SALES OFFICES: NEW YORK, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON, AND ST. LOUIS

What can Polyethylene do for you?

Polyethylene is a unique material; it opens completely new opportunities for the use of plastics. Polyethylene's properties are the best answer to the above question. It's so light it floats. It's inherently flexible. Ice will not cling to it. Its resistance to chemicals, moisture, and higher than normal temperatures is excellent. So are its electrical qualities; and its resistance to impact at very low temperatures... Further, BAKELITE polyethylene brings you another rare combination —superiority at *low price!* Compare its pound per volume cost!

How is Polyethylene fabricated?

BAKELITE polyethylene is fabricated by molding, extrusion, or calendering on standard equipment. For molding, the cavities should be designed to accommodate greater mold shrinkage, and higher mold temperatures are required to obtain improved gloss. Conventional plastic extruders—with modified die design to allow for thermal expansion—permit high speeds for such products as wire insulation, tubing, rod, tape, and monofilaments. The higher speeds are made possible by the excellent flow characteristics of the material at processing temperatures. Oriented monofilaments have excellent strength characteristics.

Where will Polyethylene be useful?

During the war, all BAKELITE polyethylene was allocated for electrical purposes, and in this field it will be found unrivalled for countless applications. Extreme resistance to chemicals and moisture makes it a superlative material for closures, packagings, and chemical machinery parts. Naturally tasteless, odorless, and non-toxic, it is a prime choice for the food industry. Molded polyethylene washers out-perform old-fashioned gaskets. Other interesting molded items include foot tubs, beer scrapers, measuring scoops, developing trays, sink strainers, and ice cube trays. Monofilaments can be used in a vast number of weaving and knitting operations. (Polyethylene comes in a wide range of attractive colors.)

Tell us your story!

Write Department 7Q about any application in which BAKELITE polyethylene might improve a product of yours, or effect worthwhile economies. The development laboratories and field representatives of Bakelite Corporation will be glad at all times to explain the advantages of this remarkable plastic and to help apply it to individual requirements. Also ask for booklet V-2, "Polyethylene Resins." Giving detailed information about their forms, properties, fabrication procedures, and uses, it may have an important bearing on your present plans and future products.

BAKELITE
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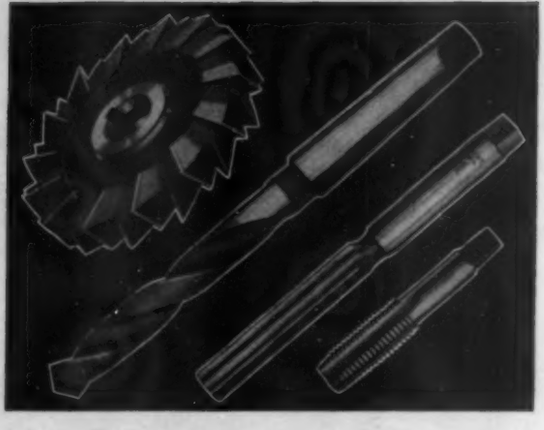

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Throughout the years, Midland has attained special skills and knowledge of the requirements for plastic molds. It has installed the finest machinery, and it employs craftsman of exceptional ability—equipment and men that are your guarantee of superior precision and workmanship — makers of hobbed cavities which meet your requirements for quality products and economy of production.

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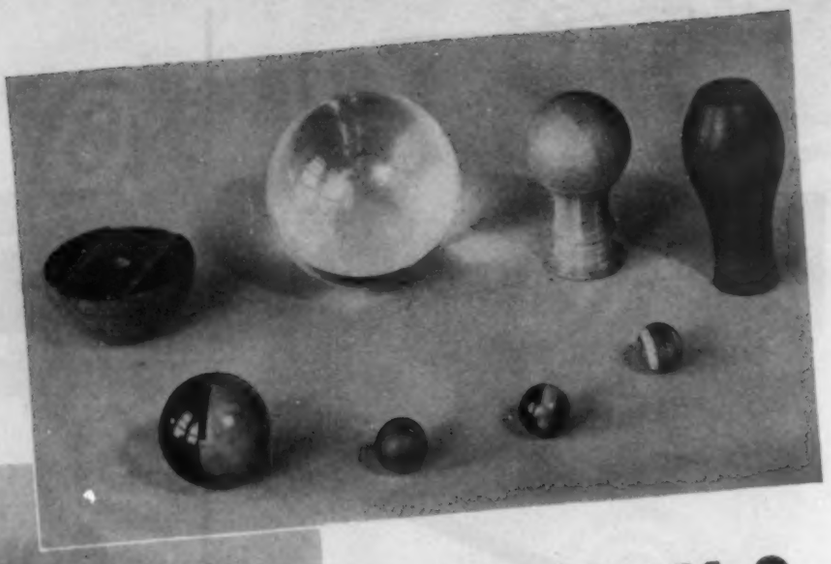

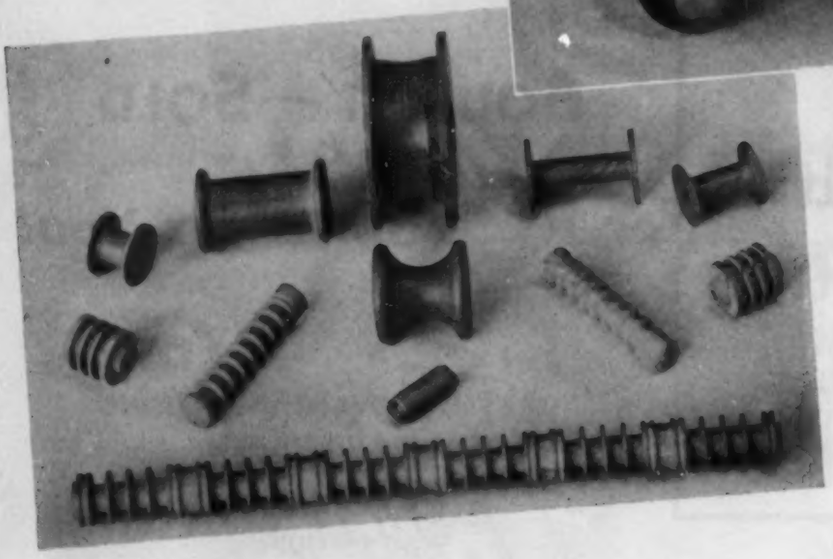

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NO MATTER HOW large, how small or how intricate a piece you are called upon to mold—whatever realizable properties are required of the material—Interlake can supply a Makalot Compound *exactly suited* to your application.

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There are low loss Makalot Compounds for high frequency applications, non-cracking for molding around inserts, non-shrinking, heat resistant, general purpose, super-impact, or with brilliant surface lustre—and—every one proved in successful use by some of the country's largest molders.

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Disston makes three types of steels for molds used in the manufacture of plastics products. Each is designed to fit a definite need. All are of exceptionally fine quality, produced in electric furnaces from carefully selected raw materials, and by modern steel practice with every process under careful control.

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All Disston Mold Steels are melted and hot-worked with great care . . . are specially inspected to assure freedom from porosity and inclusions. They are uniformly sound . . . carburize evenly . . . and produce unusually smooth cavities.

Whatever your mold or hob problems may be Disston engineers and metallurgists will be glad to help you solve them.

Write for Folder

Tells briefly and clearly what to look for and what to avoid in selecting mold and hob steels. Also contains complete analyses of Disston Mold Steels and other helpful information.

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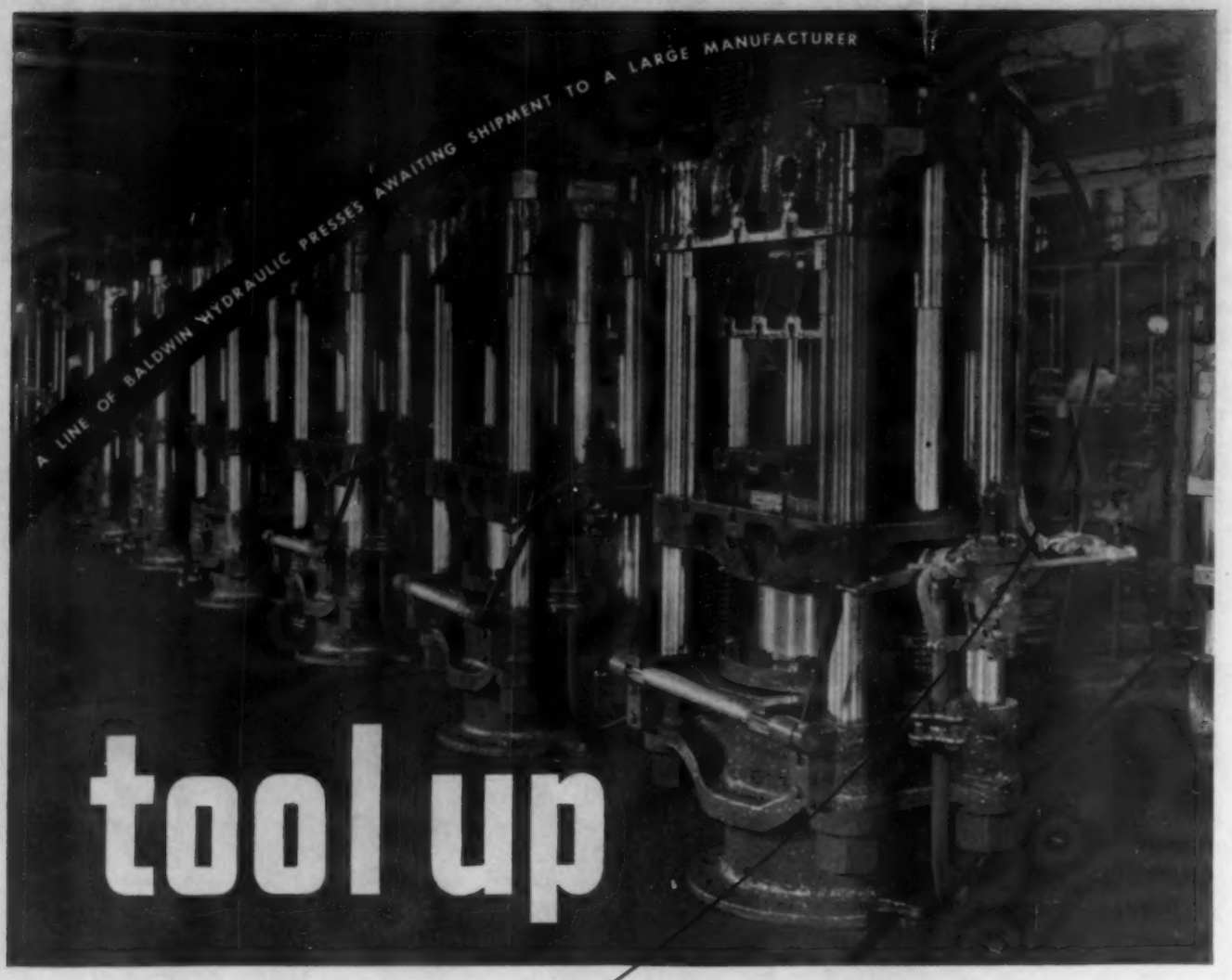

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Baldwin Hydraulic Presses combine all the newest developments to step-up production, reduce rejects and provide for maximum safety and ease of operation. Models range from 50 to 500 tons.

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SYNTILITE provided the inspiration for Para's newest bathroom ensemble—matching shower and window curtains that combine beauty and utility with a new-age sort of magic.

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It has the warmth and softness of a woven fabric, is textured to sparkle with a million lights, comes in a range of glorious moon-struck colors.

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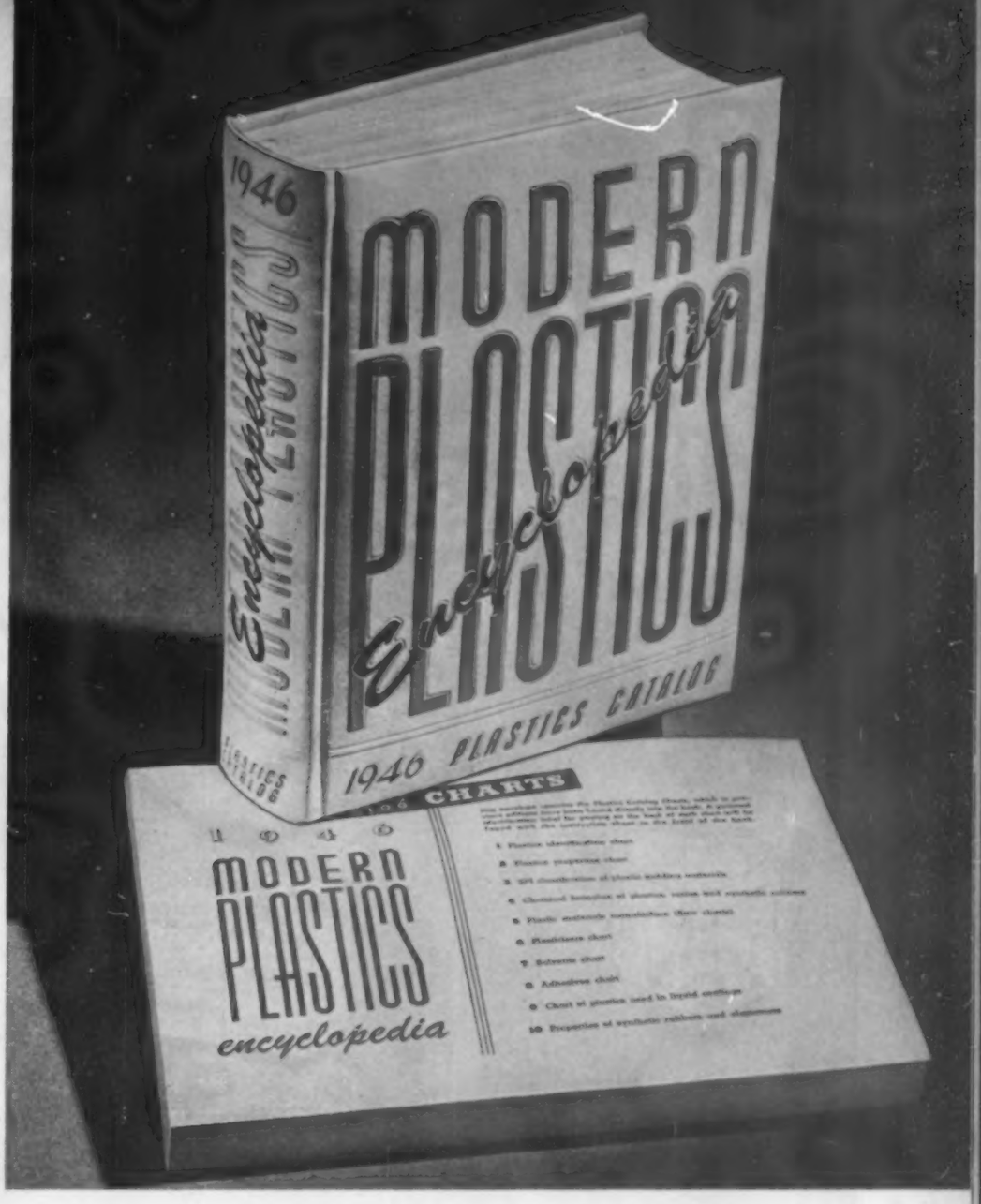

At last—first copies of the 1946 MODERN PLASTICS ENCYCLOPEDIA are off the press. So huge—1390 folioed pages—with ten gigantic charts—you'll wonder how this tremendous volume, crammed with new material, new illustrations, new photographs, could be sold at so low a price!

This is truly the Encyclopedia of Plastics. Its 135 separate chapters detail every phase of plastics materials, machines, methods and applications. Its charts bulk so large that it was a physical impossibility to bind them into the Encyclopedia—so, this year you have them neatly folded into an envelope and with identifying labels for each.

The introductory section of the Encyclopedia is a condensed handbook of plastics—what they are, how they are made, how they are processed, and all their various points of utility. This section is a stimulant to the thinking of every plastics-conscious executive—and an inspiration to members of the industry as well.

A limited number of copies of the 20,000 printed this year still remain to be spoken for. At present rates of sale, the edition will be exhausted in a few weeks. The publishers urge every interested industrialist to place his order now.

Same low price as last year - - -

$6 a copy

$7 foreign and Canadian

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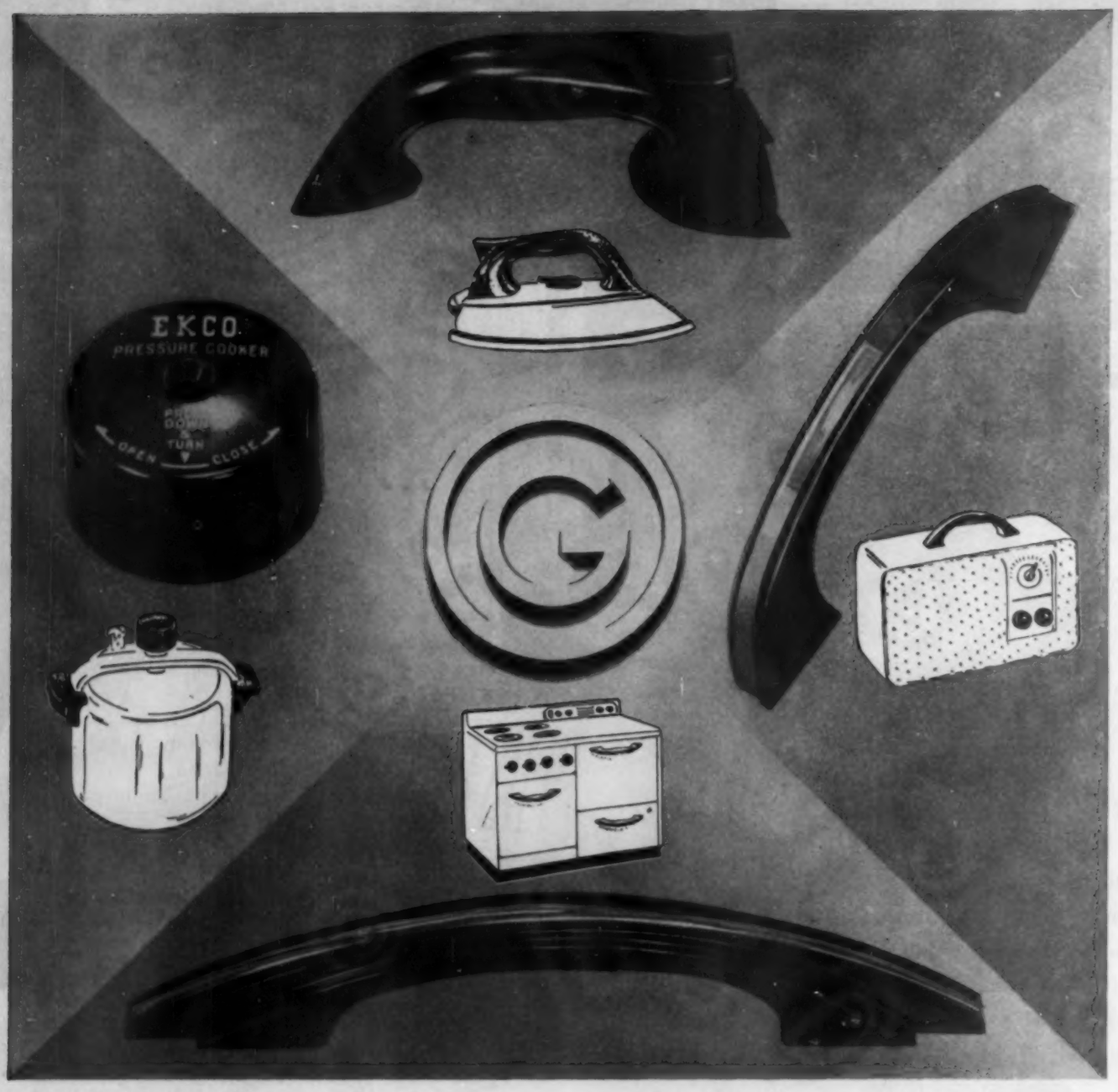

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For 19 years we've supplied many nationally prominent manufacturers with parts and trim for their products. The *versatility* of our facilities and our molding experience enable us to create unusual design or standard plastic items.

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Write for 1946 Catalog

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Dowtherm heating gives the unparalleled advantages of high temperature *without* high pressure. At 500 deg. F. these systems operate at atmospheric pressure, show only moderately increasing pressure up to 700 deg. F.

Construction and operation is simplified by the elimination of high pressure. Also, flexible Dowtherm heating permits a single vaporizer to maintain different temperatures in rolls arranged in series.

The Dowtherm story of liquid and vapor phase heating is told in Bulletin ID-46-3. Address any branch office, or

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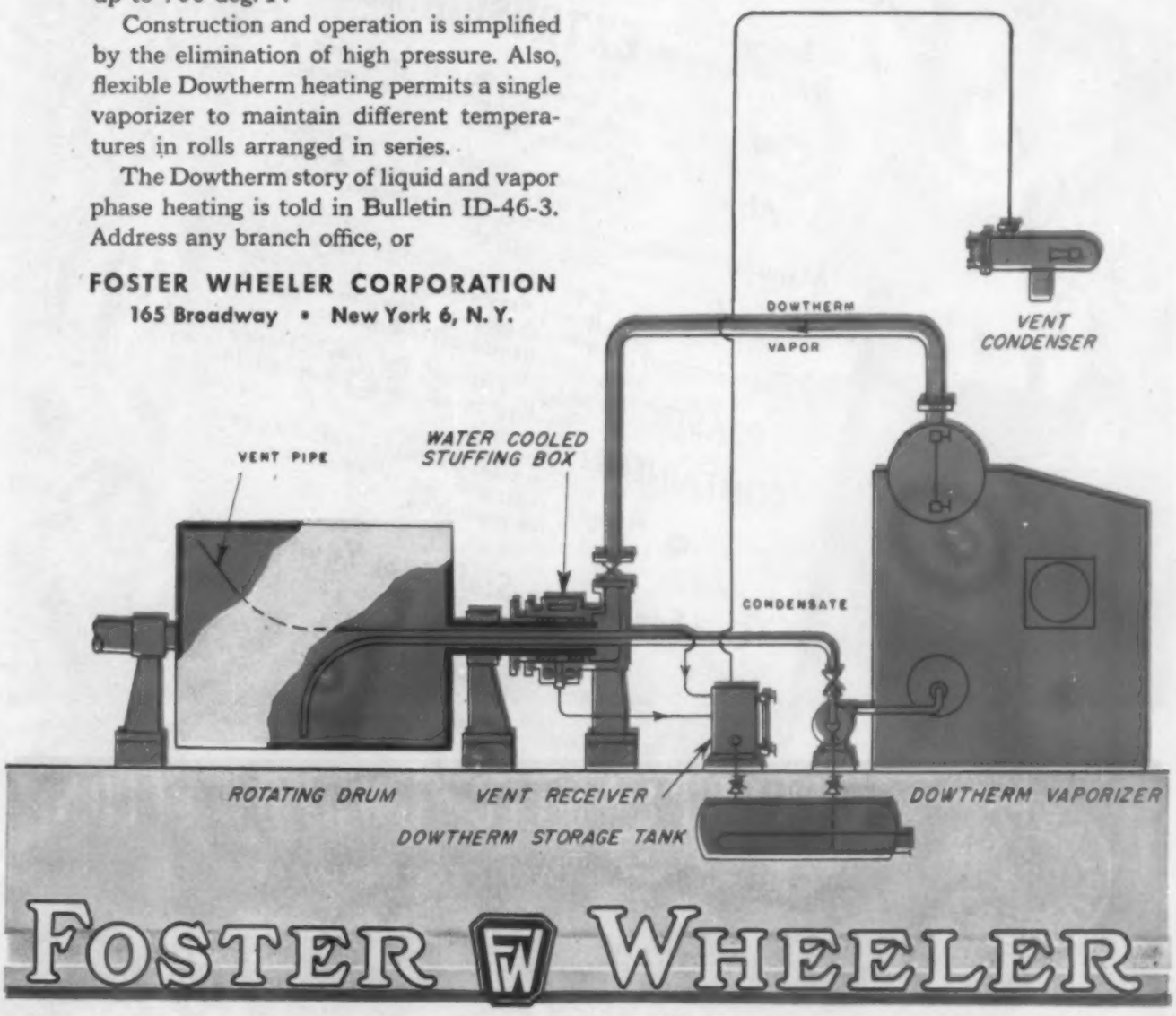

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1. Provides for controlling and varying the temperature as it is being applied to the material being tested.
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3. Determines the plasticity properties while these changing conditions are taking place.
4. Assures an accurate means of observing and recording the results of such changes. For this purpose an automatic recording device is furnished.
5. Thus the machine plots the flow of the material against time.

If you have not already received your copy of Bulletin 23, giving details of the complete line of Olsen Plastics Testing Equipment, write today on your company letterhead and a copy will be sent to you by return mail.

Proving every day that the value of testing depends on the quality of the testing equipment.

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In the big plastic molding plants down east where competition is tough, inspection is close—and production really counts—they're buying new LESTERS.

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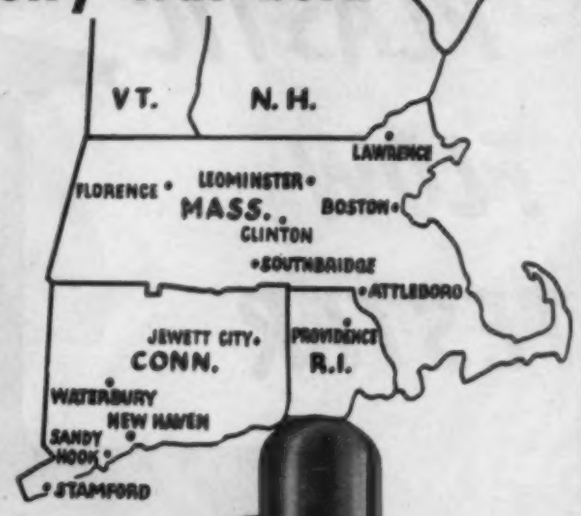

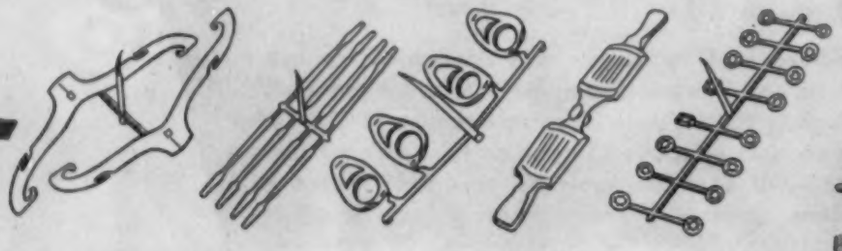

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1. Vertical injection cylinder, solid plunger and internally heated torpedo plasticizes material faster.
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WRITE TODAY for details and specifications on the *new* LESTERS

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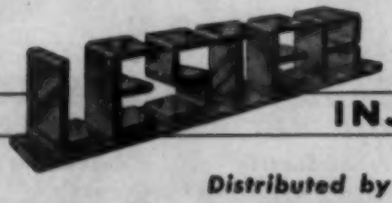

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"on the beam"

WE OPERATE on a very high frequency of plastics molding assignments from manufacturers in the radio and electronics field. Their confidence in our ability to best serve them in this specialized field is expressed in two ways . . . our large number of repeat assignments . . . the variety of these assignments.

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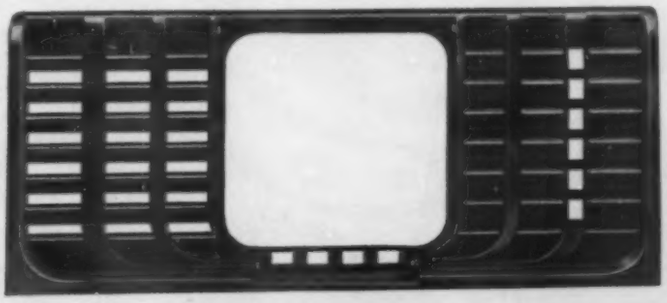
Elmer E. Mills Corporation engineers will treat your particular plastics molding problem with similar "on the beam" exactness.

Your finished product will be both a source of pride and profit to you. Investigate our injection molding and extrusion services today.



Grille, Molded for the New Zenith "Trans-Oceanic" Portable Radio.

Write on your letterhead for the new Injection Molded and Extruded Plastics catalogue. Or, for detailed information about MILLS-PLASTIC* pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trade mark Reg.

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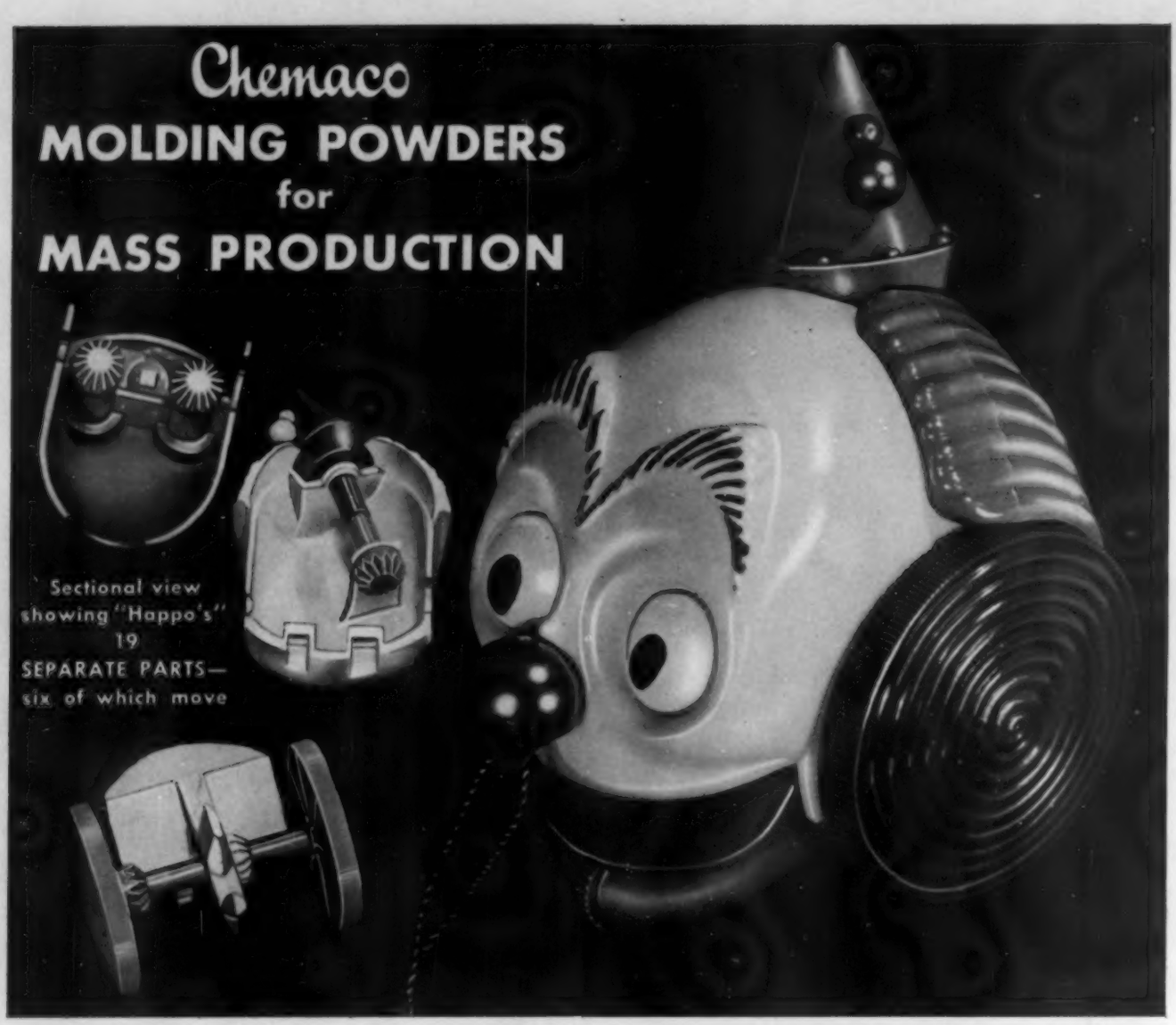


MOLDED BY MACDONALD MFG. CO. FOR CINDERELLA MFG. CO., NEW YORK CITY

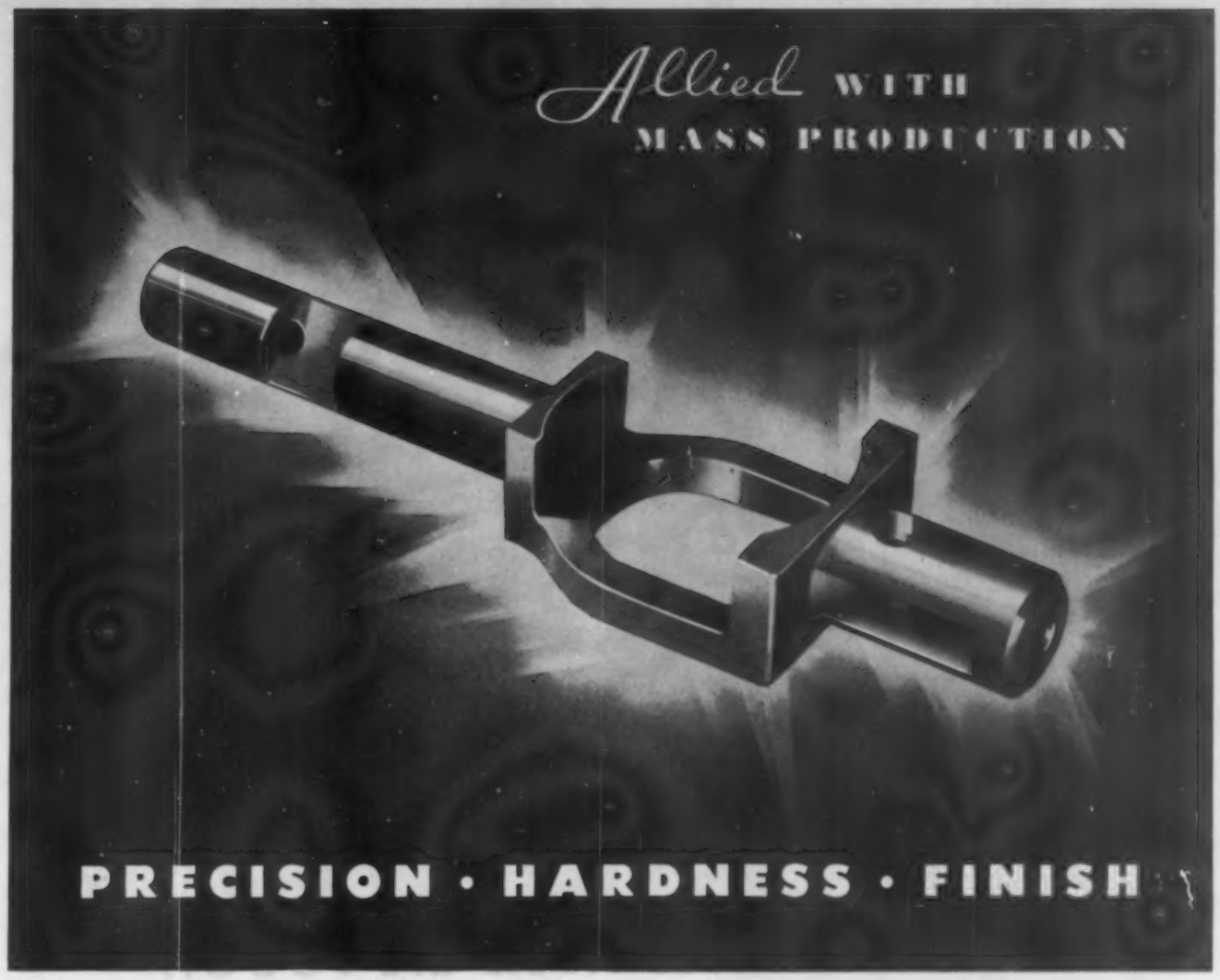
IN THE WORLD OF TOYS... This gay looking gent is "Happo" — a pioneer for plastics in the mechanical toy field. Pull him! His mouth opens, his eyes roll and his hat whirls! Because of the complicated gear mechanism, heretofore possible only in metal, a plastic material was needed that would not warp because it was dimensionally stable . . . a material that would take an unbelievable amount of abuse because of its high resistance to impact. Chemaco Ethyl Cellulose Molding Powder met these requirements and had the added appeal of a wide range of permanent colors that would not chip or wash off. "Happo" is just another example of the adaptability of Chemaco Ethyl Cellulose to mass production. Full information about Chemaco Molding Powders for injection molding and extrusion, including Cellulose Acetate and Polystyrene, will be furnished on request.

Chemaco Corporation

A subsidiary of Manufacturers Chemical Corporation

Berkeley Heights, N. J.

Branch office in Cleveland



Perhaps you are developing a product in which hardened and precision ground parts will be important. Your requirements may be simple or they may demand a high degree of accuracy . . . closely controlled hardening or carburizing . . . or an exceptionally fine surface finish such as on the part shown above. Meeting such requirements is daily routine at Allied.

Specifications for the part illustrated, as an example, called for the use of forged AMS-6250 steel, selective carburized and hardened. No decarburization was permitted on any surfaces which were to remain soft. Aircraft quality finish without trace of tool marks was required. The intricacy of the part presented unusual machining problems which were quickly overcome by Allied production ingenuity.

Whether your specifications are simple or complex you can be assured Allied's experience and skill will save you time and money. Send us your prints; we will submit quotations promptly.

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DEPARTMENT 6-A

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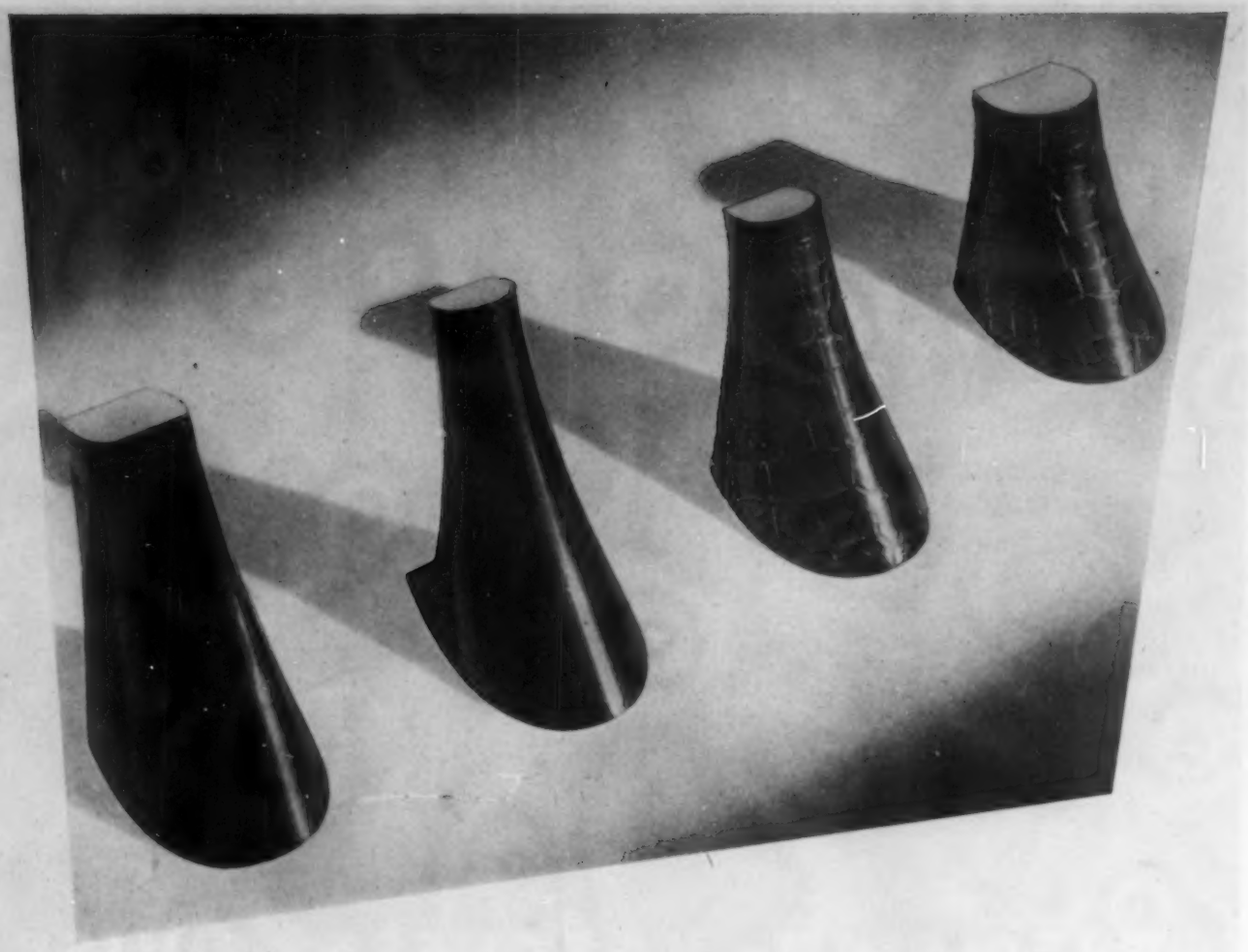

These Heels are TOUGH

Shoe heel coverings formed from Nixon C/N (Cellulose Nitrate) have what it takes to get along in a world of scuffs and scratches. They are tough and wear-resisting — and usually outlast the leather soles and heels.

For shoe heel covering . . . and for other uses too . . . Nixon C/N is a practical plastic . . . easy and economical to use.

Nixon

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C/A CELLULOSE ACETATE

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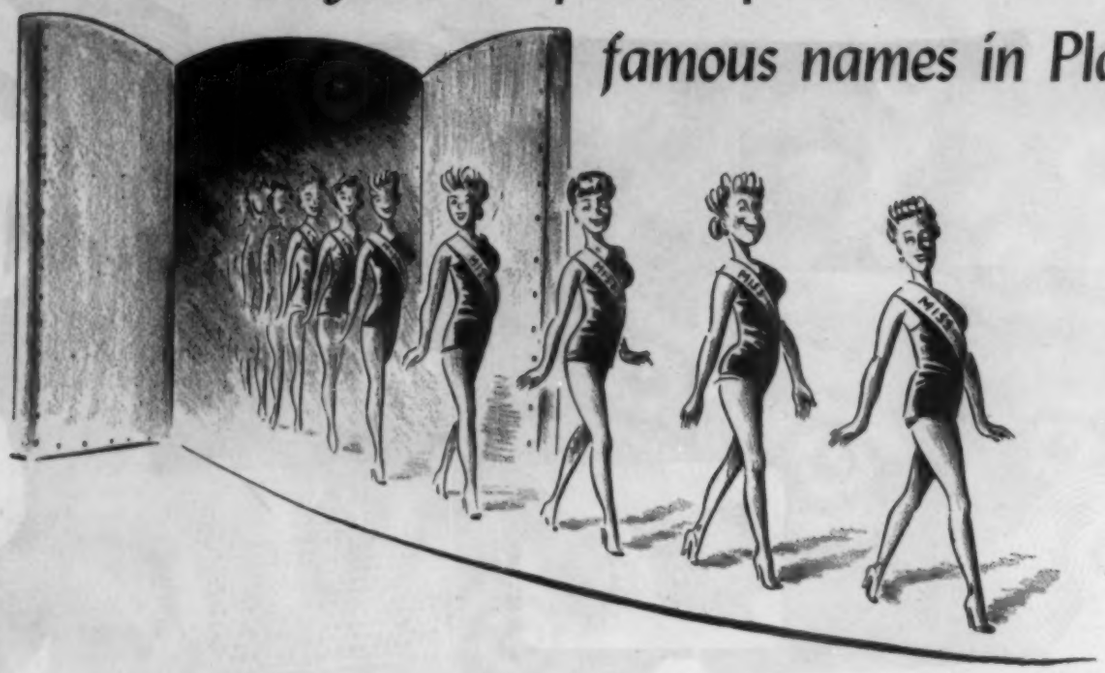

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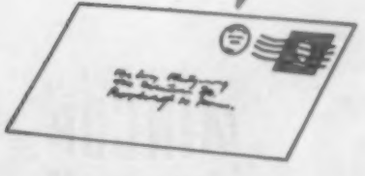

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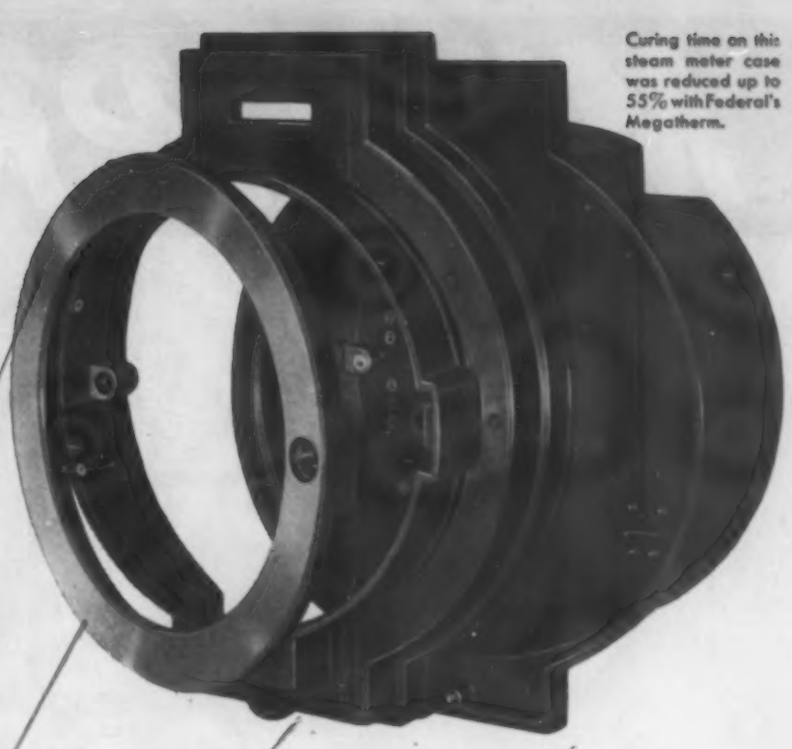

Curing time on this steam meter case was reduced up to 55% with Federal's Megatherm.

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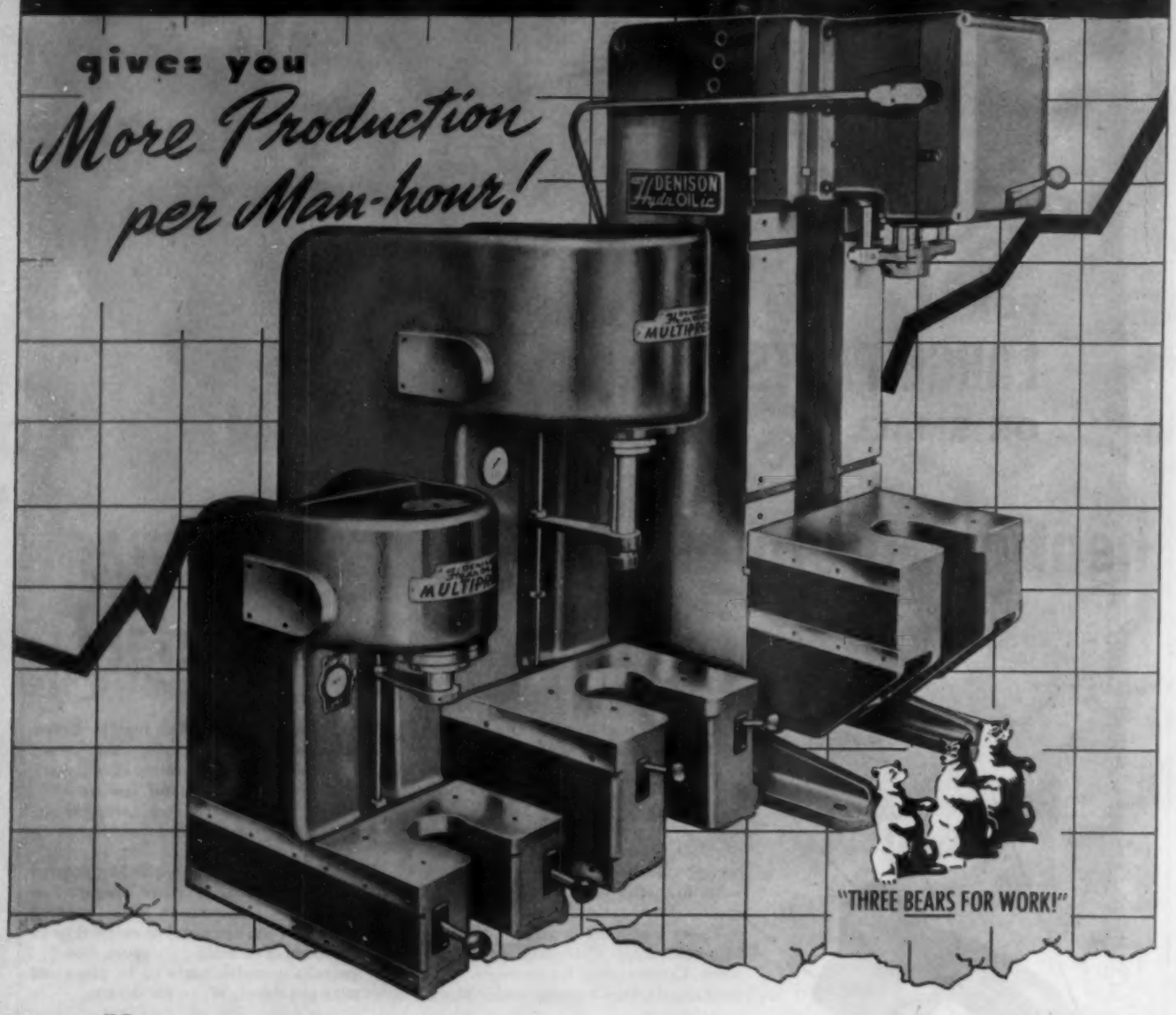

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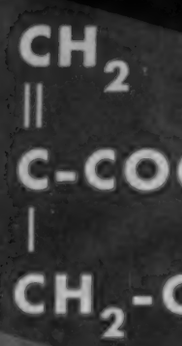

Molecular Weight . . .	130.10
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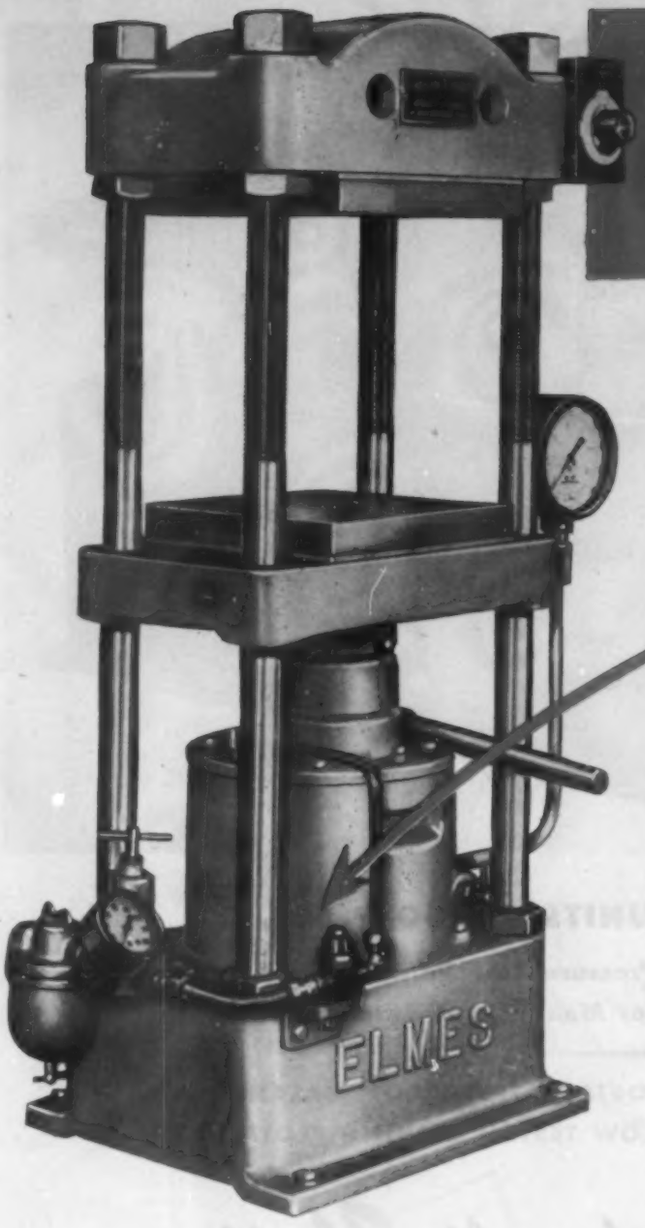

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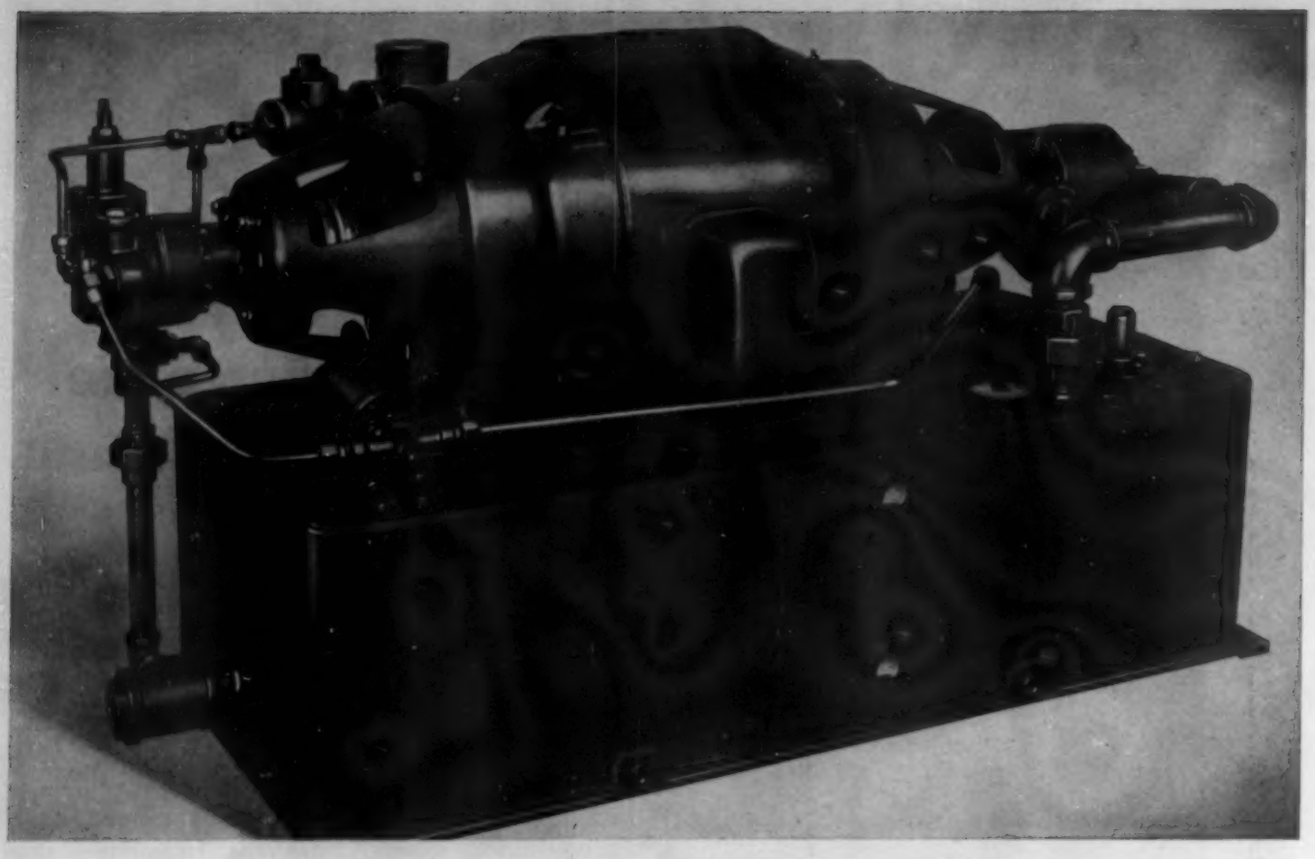

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MODERN PLASTICS
VOLUME 23 JUNE 1946 NUMBER 10

1

Every fourth toy is plastic

If toys with plastic components are added to all-plastic toys this estimate will be found wanting

SANTA CLAUS, in the persons of several thousand toy buyers from all over the world, visited the Toy Fair in New York for two weeks last March and, thanks to plastics, got the most pleasurable surprise of his long life.

While there are no sure statistics to show what portion of the total toy manufacture was given over to plastics in the past, easily a quarter of the toys exhibited at the Fair this year were all plastic. And many more of the playthings have plastic components. Certainly the newest and most unique in design are made of these materials. What this amounts to in dollars and cents may be judged from estimates that the United States wholesales somewhere between 110 and 120 million dollar's worth of children's toys each and every year.

Availability of materials is not the reason for this increased emphasis on plastic materials. Light metals are quite as procurable in most cases. And cutting, forming and die casting facilities for the manufacture of metal toys are as obtainable as molds and molding time or fabrication facilities for the making of plastic toys. Price is not the answer either. In several cases, as in motor car toys, plastic items are selling in huge volume in competition with metal toys offered at the same or at lower prices.

One reason for the continually increased use of plastics in toys is to be found in the competition within the toy industry. Probably no other industry is as keen to find

3

FIG. 1, COURTESY GENERAL TRANSFORMER CO.
FIG. 2, COURTESY WALTER B. BOSCHEN COMPANY

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2—Toys are making use of a variety of plastics. Here electric scissors are made of cellulose acetate. 3—The circus comes to town in a colorful polystyrene toy train. 4—Molded nylon is used for a child's dinner set. 5—A story in pictures is told on records consisting of a printed card laminated with cellulose acetate sheet

new and better materials and to improve its designs. Another reason why we now have more and better plastic toys is because some of the larger plastic molders have entered the toy field and some of the large toy companies have become plastic molders. In other instances toy firms use custom molders and fabricators.

There is no limit to the kinds of plastic materials used in toys nor to the methods of using them. In the lower-priced field of small toys, the cellulosics are used in the greatest volume although they also have some application in more expensive toys. Polystyrene has brought its own qualities into this field. Vinyls are used in doll-carriage hoods, stuffed toys and balls. Phenolics, ureas and melamines have also found a place. Low-pressure laminates are featured in larger items. The acrylics appear in some of the more expensive toys. Even nylon is used. Since toys range in price from 5 cents to 50 dollars and in age appeal from 8 days to 80 years this versatility in the use of these materials is not surprising. In fact, only plastics is broad enough to provide that versatility.

Let's look at some of Santa's samples

The youngsters in Fig. 1 are playing with the Zoo Fun animal construction kit featured by Metro Toy Co., the plastic parts being molded from Nixonite by Boonton Molding Co. The blue, yellow, orange and red curved pieces may be made into five different animals through the use of ingenious screws which thread into coil spring couplings. Metro Tool and Die Works made the models and the molds. An 18-

cavity and a 14-cavity mold are used to produce the 32 pieces on which there is practically no finishing work. Design and mechanical features are patented.

A pull-toy train shown in Fig. 3 is the first of a new line of Hensy toys being introduced by the Walter G. Boschen Company. The polystyrene train comes in two models, a circus train and a freight train.

Story Book Record Co. makes the nursery records shown in Fig. 5. Cellulose acetate sheet is laminated to both sides of a lithographed card, and the story or rhyme recording made on the acetate. The company finds that the records hold their flat shape, give excellent tone reproduction, used on good phonographs.

Figure 7 illustrates the Banner Plastics Company's new line of toy trucks, molded from cellulose acetate. The trailer at top has a hinged drop door at back and a folding leg which permits it to stand apart from its tractor. The tank truck has a port for filling on top and a tiny stopper for emptying at the bottom rear.

Tri-State Plastic Molding Co. features the jet propelled boat shown in Fig. 8. Molded of cellulosics in an 8-cavity mold for the low price field, it has a small chamber at the stern into which a propellant such as baking soda and vinegar, or a seltzer tablet and water

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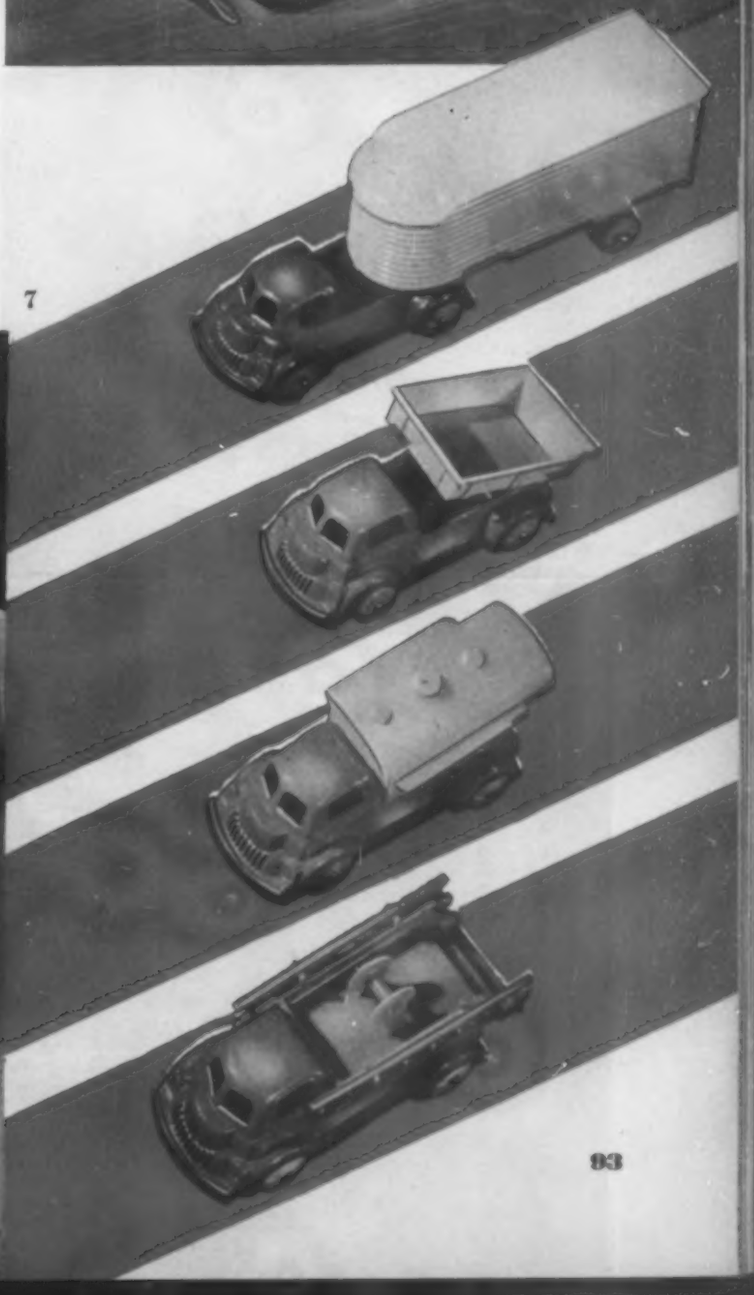

8

6—Complete sets of plasticware number 6 to 55 pieces, are of polystyrene. 7—Toy trucks, with such realistic details as detachable trailers, hinged doors and movable loading sections, are molded of cellulose acetate. 8—Getting into the mobile class, this boat, utilizing cellulosics, is propelled by dropping a seltzer tablet in an underwater chamber. Gas created causes boat to move

are placed, then stoppered with a rubber cork. The gas thus created can escape only through an exhaust at the stern below water line, causing boat to move.

Bergen Toy and Novelty Co., one of the largest companies specializing in toy figures, has reconverted from soldiers, sailors, airmen and nurses to cowboys, Indians and horses (Fig. 11). While several materials have been used at various times, the company favors cellulose acetate. The horses turn out beautiful dapples from the careful blending of the molding material. Riders and standing figures are hand painted.

Polystyrene is used by Columbia Protektosite Co. in molding the dishes used by our dainty model in Fig. 6. They come in complete sets of from 6 to 55 pieces and may be added to—just like mother's. The same company molds the nylon feeding set shown in Fig. 4. Unbreakable, boilable, smooth, and light in weight, it is superior to those made of non-plastics. Plastic Art Toy Corp. of America markets both sets.

M. E. Hunter Mfg. Co. in designing its Dolly Dell toy iron (Fig. 9) decided to give small sister a miniature of the real thing, so chose phenolic material for handle and movable control button. Consequently, the iron may be heated safely and serves as a good introduction for the little girl to the place of plastics in home appliances. Durez 792 powder was chosen for the parts which are molded by Eclipse Moulded Products Co.

"Snippie," the electric toy scissors made by General Transformer Corp. (Fig. 2), has a cellulose acetate body molded by American Molding Company. Something new in kaleidoscopes is offered by Steven Manufacturing Co. and shown in Fig. 12. Plastic body and removable top are molded by Tri-State Plastic Molding Co. When the top is removed, the head may be filled with colored glass chips, pieces of plastic, rubber bands, macaroni or anything else, resulting in an endless variety of patterns. Patents have been applied for.

The nursery clock by Plastic Treasures, Inc., shown in Fig. 10, is an interesting combination of wood, metal and plastic. Rod and rings are cellulose acetate extrusions made by R. D. Werner. Base is wood, as is paper-faced clock piece. At the back is a metal bank.

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12

9—Just like mother's, a miniature electric iron has phenolic handle and control knob. 10—Delight of a child's room, a clock with extruded cellulose acetate rods and rings as trimmings. 11—Cowboys and Indians are back. Men and horses are molded of cellulosics. 12—A plastic kaleidoscope revives the fun of viewing patterns and colors

1

2

3

Baby toys must be TOUGH

Other musts for baby toys are color fastness, nontoxicity, lightweight and shatter resistance

A TOY'S eye view of your little bundle from Heaven would surprise you. Just watch the cuddlesome innocent sometime while he chews, sucks, wallops, throws and pounds his favorite rattle. And consider the fact that the toy is his constant companion. Then you'll see why plastic toys are taking over this market.

A baby's first toys must be brightly colored, and the color must be permanent. His toys must make a pleasant noise, loud enough to amuse him yet not enough to frighten him. His toys must float, therefore must be hollow. They must be very light in weight. They must be smoothly round. And they must be unbreakable. Only plastics meet all of these exacting specifications.

Cellulose acetate, cellulose nitrate and urea-formaldehyde are the most generally used materials for these toys. Hollow components are made from the former compounds; solid parts from the latter. Occasionally acrylic teething rings will be attached to rattle bodies made from cellulosics or ureas.

The design of these toys, their molds and fabrication jigs look simple. They aren't. Figure 1 shows some items made by Playskool Manufacturing Co. which are the result of years of study by consulting psychologists and designers. Molded from Tenite I by Peerless Molded Plastics, Inc., they are balanced in weight, are designed to produce a definite rattle tone and have handles measured to fit the average infant's hand. Colors are white, pink, baby blue and the primary range of red, blue, yellow.

Figure 2 shows the Klippy, featured by Plastic Treasures, Inc. It can be clipped to crib, high chair or carriage. The triangular foot of the doll can be pulled or chewed. Nothing to it? Only that R. D. Werner has to produce a cellulose acetate extrusion with a given hardness of flow to give the clip proper spring and strength. Only that the elastic used to thread the figure must be neither too strong nor too weak. Only that the ball body molded from urea by Synthetic Plastics, Inc., had to be made to specified weight. But the payoff lies in the fact that the manufacturers have a Klippy Junior with which little girls may bring up their baby dolls.

Childhood Interests, Inc., make the tri-cornered Jingle teether from urea formaldehyde and pack it in a rigid cellulose acetate container which keeps it from dust when not in use. They are shaped and weighted to fit into a child's mouth without stretching it, yet are large enough to preclude any chance of their being swallowed. An interesting feature is that the jingles may be added to the teether one at a time as the baby grows in strength and requires more exercise. The colorful pieces are strung on a surgical rubber collar which is fastened in such a way as to make it impossible for the child to remove from it any of these plastic teethers (Fig. 3).

1 and 2—In this motor and transformer construction set, cellulose acetate is used for molding transformer box and cover, motor base, commutator caps and tube

Properly designed plastic sets rate above metal kits in color and lightweight

FIGS. 1 AND 2, COURTESY KELMAR CORP.

Construction sets turn to plastics

STARTING with the premise that every kid is an engineer at heart, several companies have for years been doing a big business in metal construction sets, generally comprising strips of metal that have been punched with holes and such accessories as bolts, nuts, gears, axles and string.

The entry of plastics materials into this field, several years before the war, was not very successful because of poor design. The chief fault of the early plastic kits was that they were copies of the metal ones. The strips lacked shear strength and were inclined to torque or twisting. They were not heavy enough for the tasks to which the kid engineers frequently put them.

Now on the market are some excellent engineering construction kits made of plastic—and made right. We present three, one of which—a set for making a simple electric motor—could not have been designed for anything but plastics.

Cinderella Mfg. Co., whose Happo clown toy was featured in our April issue, makes the Tech construction kit shown in Figs. 4 and 5. Girders, plates, platforms, couplings, gears, hubs and wheels are molded from polystyrene by Cincinnati Advertising Products Co. to insure firm joints, the lock washers are made of Tenite II. The plates, girders and wheels, which are of hollow construction, are designed with bosses to eliminate strain at those points where one part is joined to another by coupling and lock washer. Almost any type of machine can be built with this set, thanks to the flexible gear arrangement which allows the same gear to be used in combination for spur and bevel gears or any other combination of angle gears.

Toys built with this set have taken every type of punishment to which metal could be subjected, and have stood up to it. Naturally wide color variety is possible with these plastic kits. And the light weight of the assemblies is also a decided advantage.

A model made with the Constructo set manufactured by Plastoy Co., Inc., is shown

in Fig. 3. The basic principles of strip construction have been adhered to, but with a difference. The cellulose acetate strips are extruded by R. D. Werner Co., Inc., with a right-angle cross section, giving the strips a stability against torque quite as good as that of a flat metal strip. The toy manufacturer uses a unique punching machine which punches holes in both angles of the strips at a rate of 600 holes at one time. The corner trim is a separate operation. At present, bolts and nuts for assembly are metal, but plastic is now being tested for this application. If this proves to be successful, the construction kit will then be made entirely of plastics materials.

Figures 1 and 2 show the Kelmar Corporation's Pow'r House motor and transformer assembly construction set. Transformer box and cover, motor base, commutator caps and tube are all molded from cellulose acetate by Eclipse Moulded Products Co. It is a naturally sound way of teaching Junior the relationship between plastics and electricity, since it runs on 110 volts AC and transforms down to 6 to 8 volts for use in driving Ferris wheels and other moving toys made by the company.

This toy company's merchandising policy is worth some study because it keeps the young customer interested and in contact with the company. The boy becomes a member of the Society of Junior Pow'r House Engineers, receives a membership pin and a constant flow of direct-by-mail promotion material, well written and educational in nature. Since all kids graduate from small construction kits to large ones and are constantly adding pieces if they are made available, this effective merchandising technique not only makes but keeps customers.

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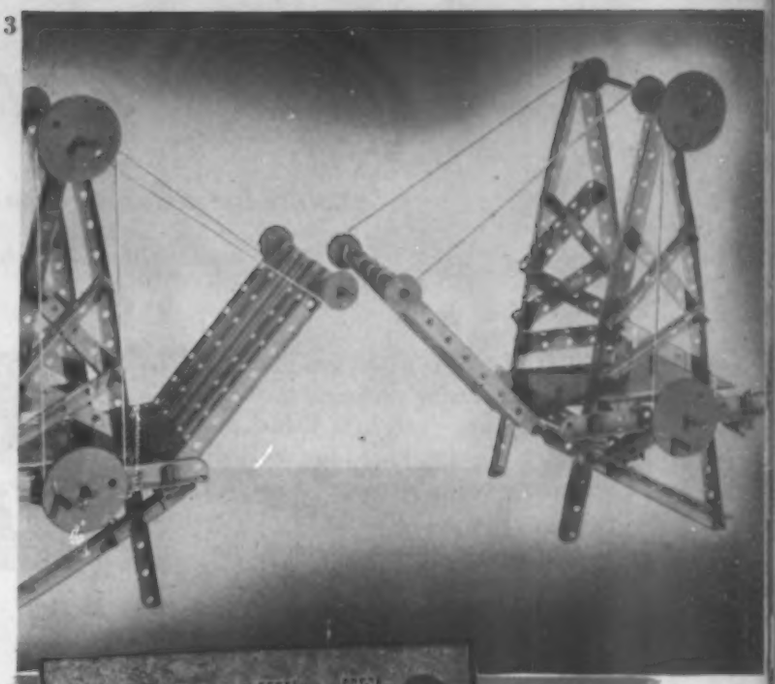

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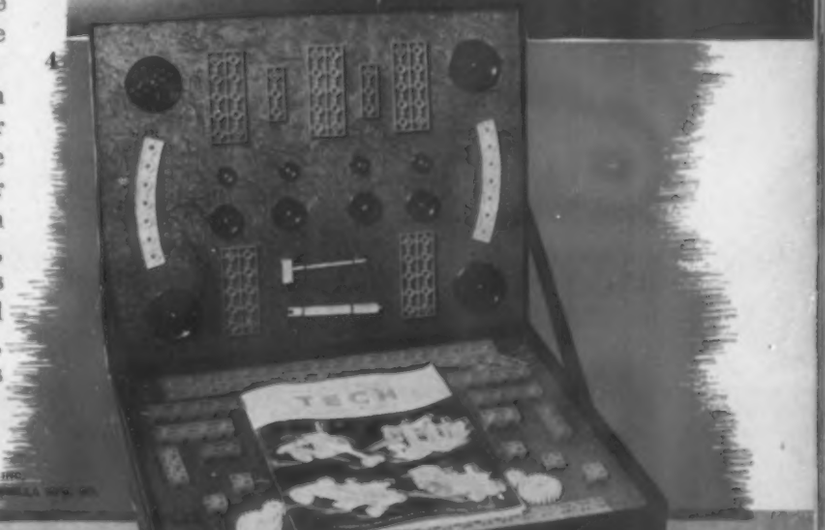
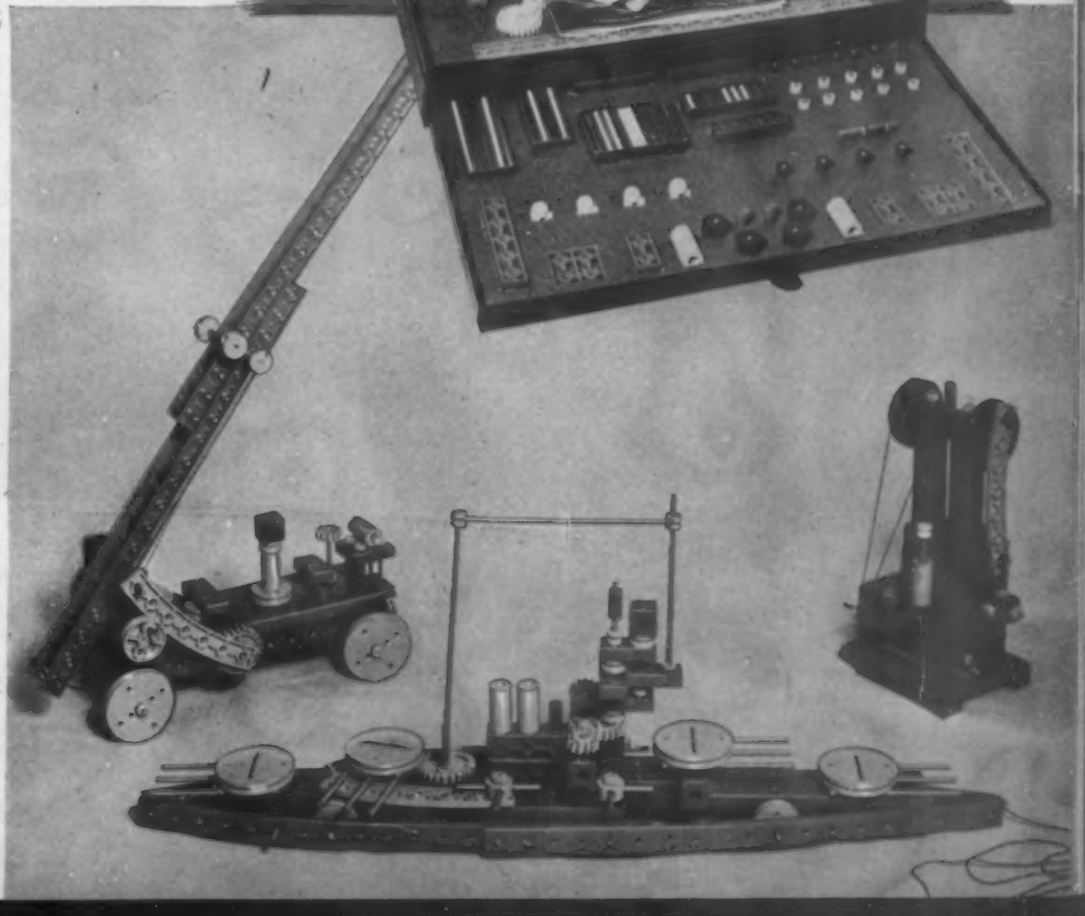


FIG. 3, COURTESY PLASTOY CO., INC.
FIGS. 4 AND 5, COURTESY CINCINNATI MILLING MACHINE CO.

5



3—Right-angle strip extrusion of cellulose acetate form the girders in this engineering set. 4 and 5—This construction kit uses polystyrene plates, wheels, girders, gears and coupling fastened with lock washers made of cellulose acetate butyrate for strength

Models mean fine molding

Minute attention to details, in making of parts and in their assembly, is what makes a perfect model

DOING things with our hands. The rage has swept through the children's and young people's fields and developed to a point where the most detailed parts and supplies were necessary to satisfy the demands of enthusiasts who wanted the miniature ships, planes, trains, and submarines to be precise to the last detail.

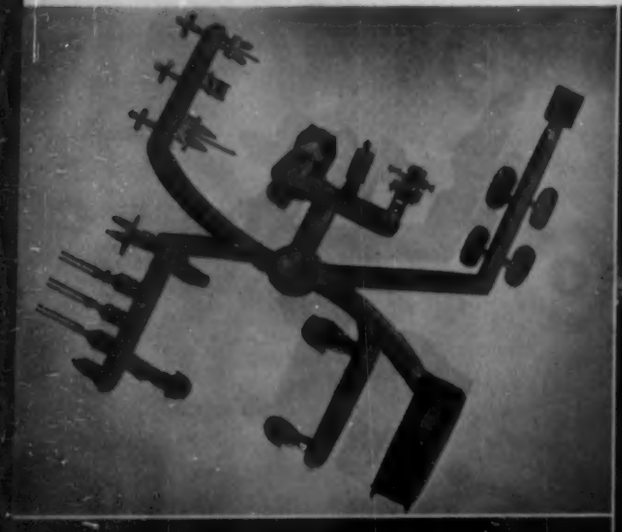
It was to meet this market that Varney Scale Models, an organization which caters to model makers, was built up. And the man behind the movement is Gordon Varney. Being a student of sublimation, Mr. Varney is convinced that you will be better able to handle tomorrow the problems that worry you tonight, if you will concentrate on making a Varney model and let your subconscious do your worrying while you are so occupied. He has built a big business on this basis. His model kits sell by the thousands, even to people who have no worries, but who enjoy reproducing ultra-detailed miniatures of complicated objects.

He started with a model railway car and followed soon after with a plane—a PT-17 made out of chrome yellow Tenite and black Tenite II, which was so good that it flew right out of the model field to become a display and decoration piece. Then came the 15-in. fleet submarine (Fig. 4). The body is wood, the mount glass, the details cellulose acetate. Next came the famous Varney PT boat with over 130 parts of wood, metal and plastic, all made to scale, intended for assembly by amateurs. Figure 3 illustrates this miniature model.

Mr. Varney could have rested, but he didn't. Probably sublimating his own worries, he brought forth the LST, a model of the famous tank landing ships which delivered the vehicles of victory to so many isles of the Pacific and so many beaches of Europe. Figure 2 gives a good idea of the detail in this model. It looks so real you want to climb aboard.

Varney, the model man, couldn't do all this without

1



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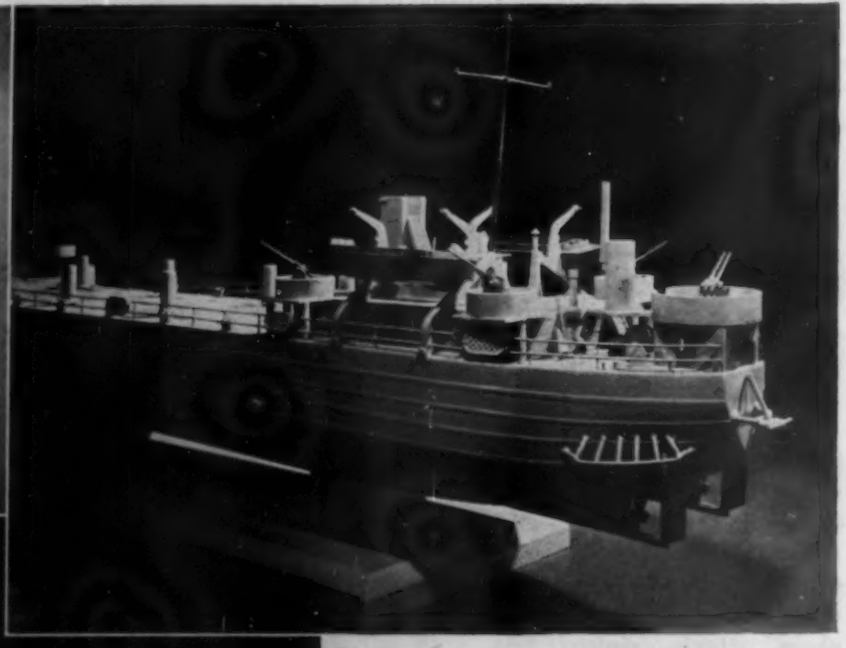
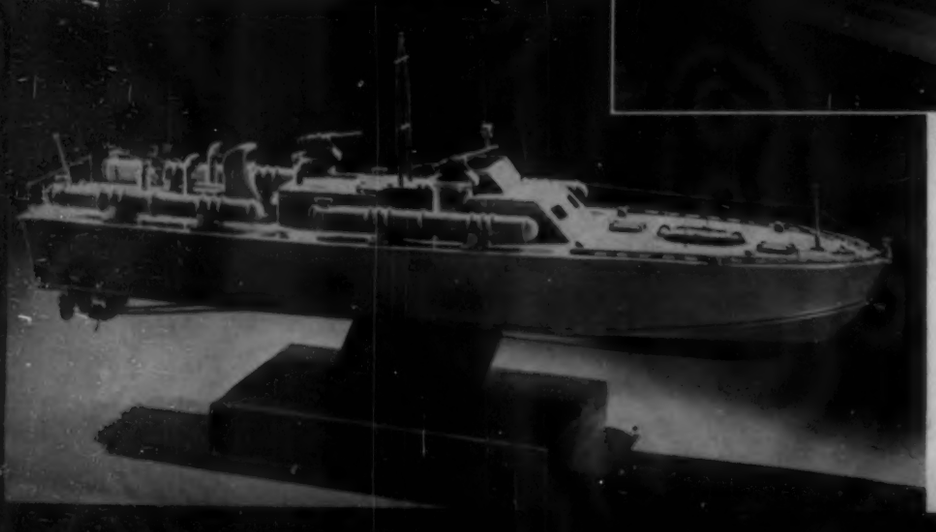
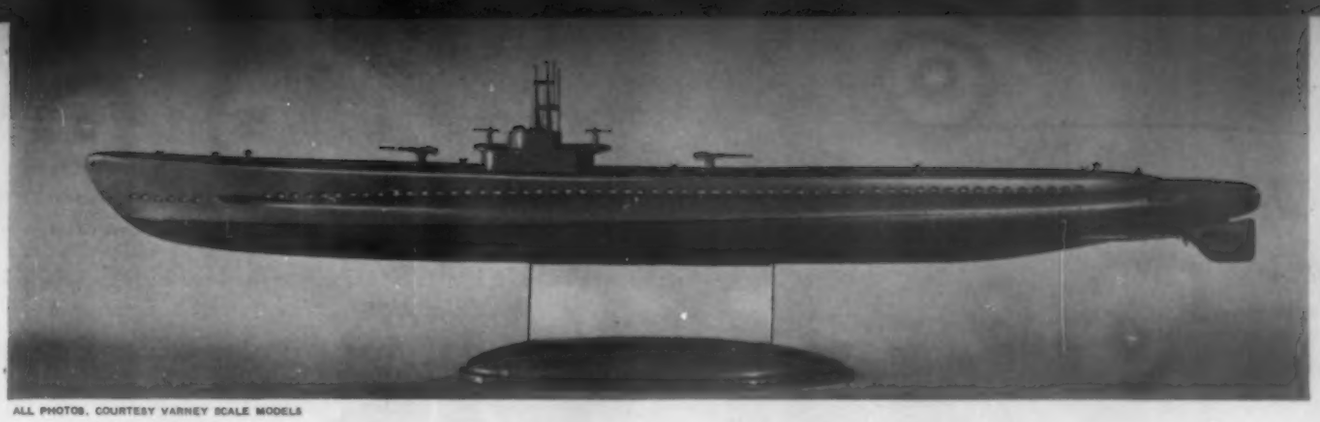




3

1—View of underside of one of the ¾ oz. sprues on which cellulose acetate model parts are produced. 2—Plastics account for the accuracy of the component parts of the miniature LST ship. 3—Kit for the PT model boat contains over 130 parts



ALL PHOTOS, COURTESY VARNEY SCALE MODELS

4—Scores of detailed molded plastic parts are used on this 15-in. scale model submarine which has a wooden body

going to some trouble. Landing craft $1^1/_4$ in. long, cargo winches which would fit into $^1/_4$ in. cubes, $1^1/_{16}$-in. anti-aircraft guns, $^3/_8$-in. anchors, $^1/_2$-in. life rafts and a score of other items had to be produced in quantity at a rate that would keep up with the worry-avoiding model makers of the nation. How this was done is evidenced in Fig. 1. It's a sprue from a molding by Continental Plastics Corp. (who does all the Varney molding) looking from the bottom up. The sprue weighs somewhat less than $^3/_4$ of an ounce.

Minute detail is secured without flash by using a 4-oz. press and producing one sprue per shot. The trick is to limit the number of cavities in each mold to as few as possible so that the runners shall constitute the major part of the volume of each shot. Fine control of temperature and cycle also play their part.

Miniatures can be made perfect models only by minute attention to detail; made in quantity only when much of the material is molded. Mr. Varney's advice to worriers: make models—don't manufacture!

A child's molded rocking horse

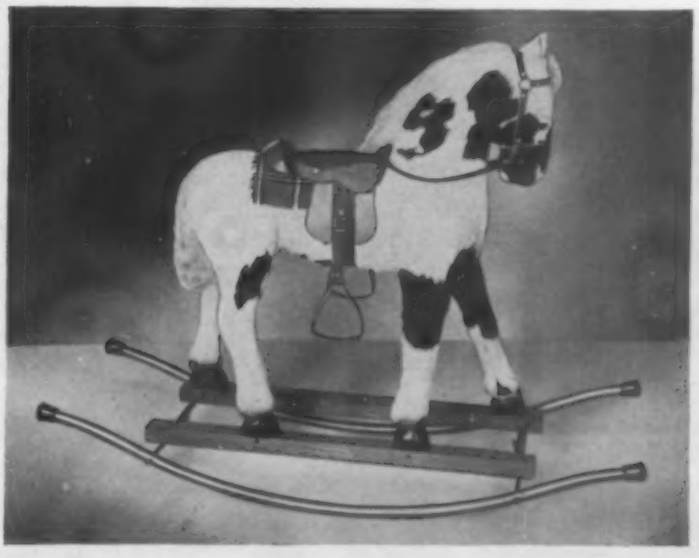
WITH a phenolic laminate body, a mane and tail made from vinyl monofilaments and eyes molded from cellulose acetate, this hobby horse, a product of Hollywood Toy Studios, is an example of fine toys.

The body is built of phenolic impregnated canvas sections that are criss-crossed like the canvas strips that are used in the fabrication of laminated helmets used as head protection by industrial workers. However, in contrast to these helmets which are formed by outside pressure, the hobby horse bodies are blown into shape against the mold by approximately 30 lb. air pressure. Thus, the laminate is pressed outward against the forming die. The curing is accomplished by baking the parts for from 6 to 8 hr. under sealed pressure—the cure starting at 80° F. and finishing at 280° F. The molds for this work are made of a phenolic casting resin to which a filler has been added.

After molding the body is tested to see whether it can support the required 400 lb. of weight. And then comes the finishing and assembly.

Real ponyhide skin is applied to the outside of the laminated hobby horse body and attached with casein adhesives, no stitching is required. Because genuine skins are used, no two horses are alike, yet all simulate the real animal.

On its aluminum rockers the horse stands 34 in. high, and its overall weight when ready for shipment is 15 pounds.



Left—The plastics buffet car started life as a normal Pullman coach of the type shown here. The whole of the interior was stripped to prepare for the new design

Right—The coach having been stripped, a wooden framework was built to which the laminated wall panels could be screwed. These panels are required to accept a sweeping curve to roof and a reverse curve to bar front

Renovating rail cars with plastics

"TO THE scrap heap with them" is the sentiment of most American's who traveled during the war in the plush seated, dark panelled coaches that were resurrected for the emergency period. That there is another possible fate for these outmoded railroad cars has been proved by the Bakelite, Ltd., of Great Britain, who has taken one such coach and modernized it through the use of plastic laminates and a variety of molded plastic parts. The redecorated and rebuilt coach is now operating as a buffet car on the Southern Railway's "Golden Arrow" London-Dover boat train.

The first work that was undertaken by the plastic company's Industrial Design Unit, which was responsible for the entire redesigning job, was the stripping of the old pullman coach of its original drab equipment. Everything was removed, down to the outer shell of the car, as can be seen in Fig. 1. It was then necessary to construct a wooden framework which would outline and act as a support for the laminated panels selected for the walls of the new car.

Walls, partitions, the bar and table tops in this buffet car are all surfaced with Wareite laminates[1] in a color scheme of pink, grey and cream. Display cases and curtains, are also of plastic, and the lighting equipment was designed in molded acrylic sheet. Both the colors and the plastics materials combine to impart to the interior an air of freshness and comfort sorely missed by railway travelers in Britain—and the rest of the world—throughout the war period.

The plastic laminate, which was used in $^{5}/_{32}$ in. thicknesses by Richard Levin, who directed the work of the Industrial Design Unit, weighs less than half as much as aluminum and has a high impact value. Just as

[1] Supplied by Wareite, Ltd., a unit of Bakelite, Ltd.

important is its resistance to hard and careless treatment such as the spilling of hot liquids, juices, etc. Even alcohol will not cause a permanent blemish and contact with a lighted cigarette will not raise blisters on the surface of the material.

The walls in the bar compartment follow a continuous swooping curve from floor to ceiling, taking a radius at the top of about 2 feet. They comprise alternate panels of pink and grey, a color scheme that is echoed in the upholstery material. In fact, the same asbestos fabric that covers the chairs, stools and wall benches is used to surface the plastic wall laminate—being bonded on the outside during manufacture.

For contrast, natural oak strips are used to mask the junctions between the panels, and grey strips of the Wareite laminate edge the window frames, blending with the curtains of translucent vinyl sheet.

The cream color of the laminate which surfaces the bar also acts to soften the effect of the contrasting pink and grey of the walls and upholstery. Down the full length of the car counter top appear pencil drawings of an old-time locomotive and carriages with an excited dog running alongside the train. This design is incorporated in the laminate during production.

Whereas the laminated wall panels were designed to curve inward to follow the contours of the shell of the railroad car, the front surfacing of the bar has a reverse curve. This was done to insure ample leg room for standing passengers. But it was found to fulfill more than its original purpose. This curving front is also pleasing to the eye and, what is perhaps more important, extremely hygienic. It leaves no corners or crevices which can harbor dust or dirt.

The final application of plastics in this buffet car is the translucent laminated partition that blocks off one end. Unlike the bar top and sides, this plastic sheet is undecorated.

The success of plastic materials in this redesign of an old Pullman coach should serve to set a precedent that will, without doubt, be followed in many other branches of the railroad industry—not only in Britain but in other countries as well.

ALL PHOTOS, COURTESY BAKELITE, LTD.

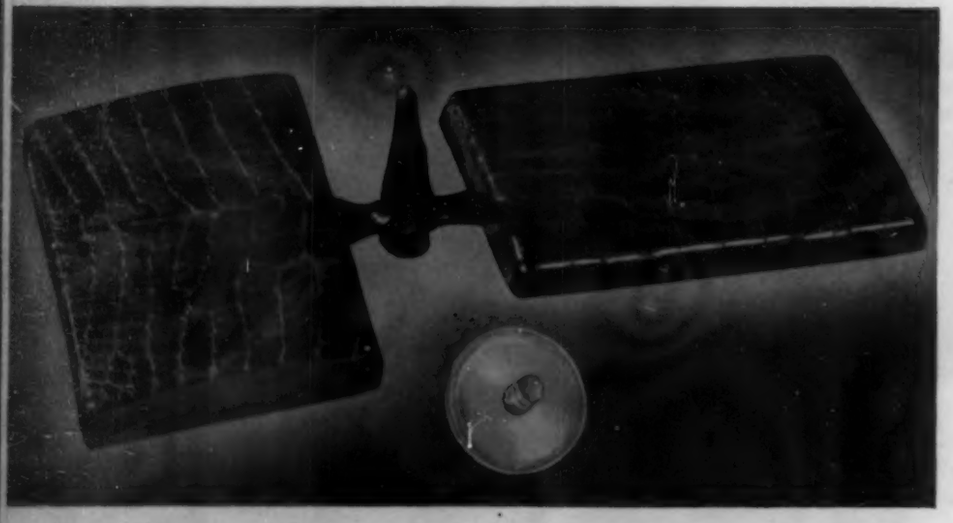
Left—The walls of this renovated buffet car are treated with alternate grey and pink laminated panels; the bar top and transparent partition are in cream-colored laminates

Right—The pink and white patterned fabric used to upholster the settee is repeated in the fabric that is the surface covering of the wall laminates. The curtains and the lighting fixtures are also plastic

Matching pocket radio and luggage

Using polystyrene for the case of this radio, the manufacturer was able to simulate the appearance of alligator skin while keeping cost low

PHOTOS, COURTESY RADIO CORP. OF AMERICA



THE pocket or personal radio, which had a limited prewar market, has come into its own in this new age of mobility. Like miniature art as compared with big pictures, these tiny models must be finer in design than big models and must also be proportionately efficient in operation.

When the RCA Victor Div. of Radio Corporation of America designed the model shown here, the company decided that it should be $6\frac{1}{4}$ in. high, should weigh $3\frac{1}{2}$ lb., should play anywhere with room volume and good tone. It was felt that an alligator skin covering would give it a quality handbag appearance in harmony with good luggage. A good-sized control knob was desired. Yet, for competitive reasons, the price of the radio, complete with all the small and expensive internal working parts, had to be kept to $26.86, a price which includes the tax.

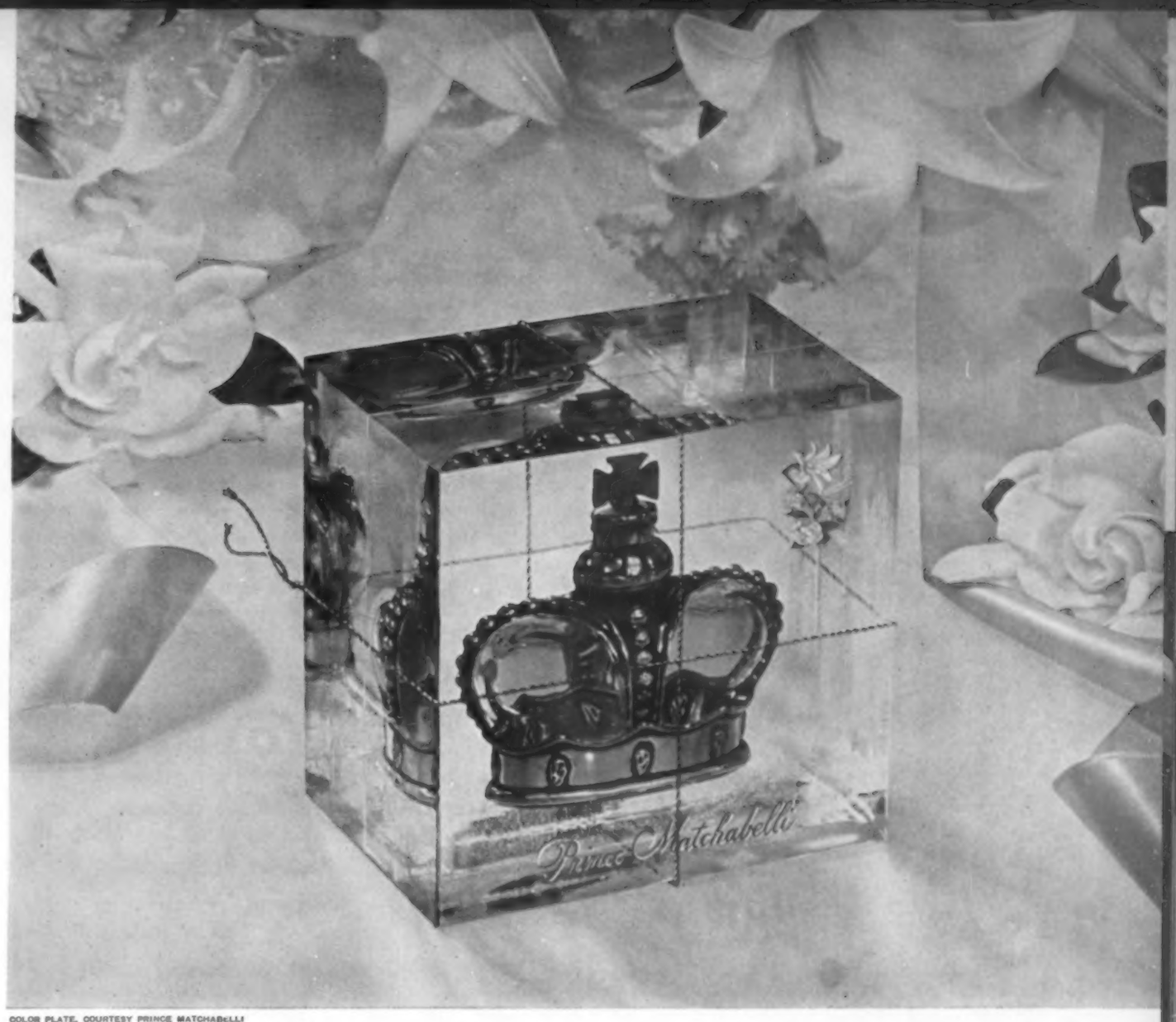
Polystyrene was decided upon for the front and back of the case which holds the zinc die-cast box that contains the radio. Santay Corp. did an excellent job of copying an actual piece of alligator skin in a molding, even running the pattern around the edges of the case by discretely considering cross sections in the hide. These side sections were found to cause a considerable drag as the mold was in process of opening, a drag that was eliminated by a gentle washing away of the lines until the shape of the side walls and the depth of the lines reached the point where the mold opened freely.

The mold was constructed with side actions pulling on 3 sides of the case. These are activated by ordinary cams, with the exception of one cam, which forms the latch of the lock ridge on the inside of the lid. This cam has an action which in effect reverses itself when the mold is in process of opening, giving the operator a completely clean molding. For finishing, the only operation required is the trimming of the gate.

Polystyrene was selected because of its electrical characteristics, its radio frequency reaction and its dimensional stability. Because of this last quality, shrink fixtures were found to be unnecessary. And rejects have been close to nil.

The knob used for station tuning is also of Bakelite polystyrene, but crystal-clear. The polystyrene is molded into a corrugated chromium-plated ring which forms the edge of the knob. A very fine metal rod pointer runs from the center to the rim, being molded in to the transparent plastic body of the knob. In assembly this knob fits down into a slight recess formed in the metal front plate of the radio where it is protected yet can turn easily. This piece has a shank specially designed to snap permanently onto the axle in the radio.

Currently produced in black, this model will shortly be available in brown and red polystyrene.



COLOR PLATE, COURTESY PRINCE MATCHABELLI

Perfume packages go transparent

THE very essence of good perfume—its elusiveness, its artful understatement—lies in the acrylic package that Prince Matchabelli has adopted for three flower perfumes held in the famous gold-encrusted crown perfume bottle. For this is a package that is more than a protective covering, more even than a display piece that will show the contents to advantage both on the sales counter and the dressing table. It is a projection of the feeling that women seek to achieve by using perfume.

At first glance one might think that this crown bottle is frozen inside a block of ice and tied with a golden cord. Actually, the transparent cube is made of Lucite or Plexiglas in two identical sections. The mold is so designed that there is a cavity on the inside that conforms to the outlines of one side of a crown perfume bottle. Thus, when a bottle is slipped into this space and the two acrylic parts fitted together, the effect is of a hollow transparent cube in which the bottle is suspended without support.

The steel dies in which this acrylic container is molded were produced from models cast in the form of the perfume bottle. Since the bottle has the same contour on both sides, the halves may be molded in the same die. This fact, incidentally, was of great help when production first got underway and the demand for the package grew to astonishing proportions almost overnight. There was no question of producing the same number of pieces from two different molds since any two parts could be fitted together to form one of these cube-packages.

To further enhance the three-dimensional effect produced by the design of the acrylic package, two small flowers are engraved on the inner surface of one of the

The halves of this package, injection molded of acrylic, are designed so that the bottle of perfume fits into cavities, the shape of half a bottle, molded in each part

plastic halves. This hand-carving work is done by Classic Studios. Originally the name, Prince Matchabelli, was engraved on the face of the container and filled with gold leaf. The designer felt, however, that the unadorned box gave a richer effect and so, after the first run was made, this signature on the bottle was abandoned.

This package, which is made for a 1-oz. and a $^1/_8$-oz. bottle, was designed by J. P. Sawyer of Morse International, Inc.; engineered, developed and produced by Industrial Conversions, Inc. It is not only an example of the correct use of a plastic material but it is an example of an article that could not have been made so successfully from any other material. Glass alone could have given the desired transparency. But glass has the two serious drawbacks of fragility and weight. Both of these factors raise problems in the packaging field which, if overcome or compensated for, often added considerably to the cost of both the package and the end product.

Having decided upon plastics, the designer of this "ice cube" neither made the mistake of stinting on the material nor erred on the side of over-treatment. Appreciating the value of acrylic's transparency, he was content with a small nosegay of flowers engraved in an upper corner. And by leaving all other surfaces absolutely clear the flowers enjoyed the full effects from the excellent light refraction properties of the plastic material.

This perfume container and others that have been produced recently from transparent plastics, indicate an ever better master of the use of plastics in packaging.

Chapter on testing for S. P. I. Handbook

"Testing Plastics Parts," the fourth chapter of the technical handbook being developed by the Engineering and Technical Committee of the Society of the Plastics Industry, is now available, according to an announcement that was made by that organization.

The new chapter relates primarily to the tests given various finished articles to ascertain their ability to stand up under consumer usage. These are important guides to manufacturers in setting up performance tests for their own products and as a means of foretelling consumer satisfaction before the product is made.

Included in the latest chapter are: impact tests to determine the strength and resistance to shocks of various products; moisture resistance tests; means for ascertaining dimensional stability; heat resistance tests; crushing tests and others which will bring out facts that will enable production of top-grade items.

There are available, of course, various generally accepted testing methods by which the physical and other characteristics of plastics may be determined. A description of these may be found in a handbook of the A.S.T.M. and in Section IV, Part 5, of the Federal Standard Stock Catalog. These are particularly valuable in establishing comparative data of the plastics themselves. But since fabricated articles are often irregular in shape and non-uniform in wall thickness and may have areas of weakness resulting from location of sprues, etc., it is often desirable to make tests on the actual article.

Heading the committee which produced the new chapter was Dr. Garson Meyer of Eastman Kodak Company. Members were: Dr. Robert Burns, Bell Telephone Laboratories, Inc.; E. B. Cooper, E. I. du Pont de Nemours & Co., Inc.; Dr. Ray B. Crepps, Owens-Corning Fiberglas Corp.; Lawrence M. Debing, Monsanto Chemical Co.; Alfred A. Glidden, Watertown, Mass.; A. J. Kearfott, General Motors Corp.; Dr. Gordon M. Kline, Natl. Bureau of Standards; Roger MacDonald, Plastics Manufacturers, Inc.; A. A. Melnychuk, Celanese Plastics Corp.; Dr. Leonard Smidth, Sylvan Plastics, Inc.; John K. Totten, Ford Motor Co.; F. E. Wiley, Plax Corporation.

Copies can be obtained by writing to the Society of the Plastics Industry, 295 Madison Ave., New York, N. Y.

Phenolic base for home sterilizer

MORE and more in this world of labor-saving devices for the home, electricity is being harnessed to take over many of the tedious tasks which once kept the housewife and mother virtually a slave in her own home. And very often these days when electricity steps into the picture, phenolic materials are to be found not far behind.

Bearing out this premise is a home unit for sterilizing baby bottles, produced by Electric Steam Radiator Corp. and equipped with a base of black Bakelite. Playing a role in the selection of the phenolic for this particular application were a number of factors. For one thing, the material possesses good heat and moisture resistance, both important where electricity and steam are involved. Then, too, it has dimensional stability and offers good heat insulation. The phenolic is also tough enough to withstand the wear and tear of constant use and makes a compact and very sleek base that, with its smooth shiny surface, is both attractive and clean-looking.

Molding the phenolic base

Compression molded by Michigan Molded Plastics, Inc., the plastic base is produced in a 3-cavity semi-automatic steam mold operated on a 200-ton self-contained press. Preforms which have been preheated in an electronic heating unit are used for the mold charge. The molding cycle consumes 4 min., 55 seconds. Finishing operations on this base for the sterilizer are limited to the removal of flash—an operation which is done by hand.

Since the phenolic part in this application must have maximum resistance to moisture, alkalies, heat and steam, the molders find it necessary to run continual tests on cure, density and other physical properties of the molded part to be sure that it is meeting the high standards required of it.

The operation of the sterilizer, known as Electresteem, is fairly simple. By means of its electrical element, the unit boils water, generating live steam and killing any germs present on the bottles which are held in inverted position in the upper part of the sterilizer. Openings are provided for eight bottles to be sterilized at one time. As a safety measure, the sterilizer is provided with a device that automatically shuts off the electricity when the sterilizing process is completed, thus preventing overheating and the consequent scorching of nipples or bottle caps. To insure a firm footing for the unit, the phenolic base was designed with squat legs molded into the bottom of the piece.

PHOTOS, COURTESY BAKELITE CORP.

1

2

1—Baby bottles inverted in this home sterilizer are easily germproofed through action of live steam. 2—Four parts comprise the unit, the base being compression molded from black phenolic chosen for its resistance to heat and moisture and its durable quality

1—*With the development of a thermoplastic inner envelope for margarine packages, the task of mixing in the yellow coloring is simplified. It is only necessary to knead the oleo-filled plastic container to break the color capsule and spread it evenly*

Thermoplastic container for margarine

Mixing of coloring matter with oleomargarine is no longer the tedious and messy job it was, due to the development of a plastic inner envelope

BY KNEADING oleomargarine that has been sealed inside a flexible thermoplastic envelope, the housewife is now able to simplify the task of adding color to the product so as to simulate the appearance as well as the taste of butter.

Present food laws prohibit the sale of factory-colored margarine. But with this new plastic inner wrapper, this restriction—which is responsible for the clear color of the margarine when purchased—should no longer be a major factor in sales resistance to margarine. Of course, despite the handicap of no color, the industry is now producing at the rate of 550,000,000 lb. per year, of which about 450,000,000 lb. are packaged for domestic consumption. However, it is estimated that every year 2½ percent of total margarine production is lost through coloring waste.

The idea for the new container was developed by Leo Peters of Harris Hall & Co. and it is now being manufactured in experimental quantities by Visking Corp. Consumer tests have proved the appeal of this package to the housewife.

Mixing made easy

The film, a thermoplastic developed by the Visking Corp., is filled with oleomargarine, and a capsule containing a dye suspended in edible oil is attached to the inside surface of the envelope. The film is then heat-sealed. When the purchaser is ready to color the product, she pinches the capsule to force the dye out into the oleomargarine so it can be diffused by kneading. The capsule is attached to the thin plastic envelope so that the dye pill will not be lost in the mar-

garine. The coloring operation with this new inner container requires only 2 min. or less; no mixing bowl is required; no margarine is wasted; there are no messy bowls, forks, knives or spoons to wash; the coloring is remarkably even throughout.

The colored margarine, still sealed inside the envelope, may be put back in the paper carton in which the product is sold and blocked back into shape. The carton may then be placed in the refrigerator to allow the oleomargarine to harden and keep. Since the margarine is contained within the thermoplastic film, it may easily be cut in neat quarters or in fancy patties.

The film is non-toxic, has chemical stability in the presence of fatty acids and brine, is colorless, is very elastic and may be produced at low cost. The retail price of margarine in the new containers will be competitive with that in present packaging. Since the film can be made without a plasticizer, it imparts no odor or taste to the oleomargarine.

First package on the market

The first company to take advantage of the new container is Cudahy Packing Co. whose "Delrich" vegatable oleomargarine has been placed on sale in the Joliet, Ill., area only for a trial run. Enclosed in the package is a self-addressed postcard informing the purchaser that he or she is among the first "to enjoy this new Delrich E-Z Color Pak . . . please tell us how you like it." Space is left for "Remarks." A huge program of advertising is planned in support of dealers, including a rather extensive schedule of newspaper releases, store posters and tie-in mats.

A special folder addressed to dealers warns them that, according to the U. S. Treasury Department, they are forbidden to *sell* or *give away* any package of margarine which is already colored. Thus, should they color a package while demonstrating to a prospective purchaser the technique of coloring, they must not give away or sell that particular package. Violators are liable to the special tax of $600 as manufacturers.

Filling the package

Because of the plastic nature of the container, the margarine must be poured into it, rather than extruded as it is into the orthodox packages. The Cudahy Company fills the inner thermoplastic envelope by gravity feed. It is possible that the thermoplastic film could displace the paper carton entirely, with trademarks and directions which can be printed directly on the film.

The packaging promises to eliminate returns due to leakage during hot weather; seal dirt out of the package completely; permit display on unrefrigerated counters; eliminate the use of dishes and pans formerly required in coloring; keep grease and hard-to-remove color stain off hands and clothing; allow easier reshaping of the colored product; and prevent margarine from picking up refrigeration odors. The envelope can be carried on picnics and chilled in water before use.

2—The first step in the coloring of oleomargarine packed in the new thermoplastic envelope is the breaking of the color capsule. 3—Then the heat-sealed film pack is briskly kneaded until the pound of margarine is colored. 4—The thermoplastic inner container with its pound of oleo may then be put back into the paper carton and blocked back to an oblong shape and cut into neat quarters

ALL PHOTOS, COURTESY CUDAHY PACKING CO.

2

3

4

Strong, sturdy and useful, this Kleenex box is made to hang on the wall or rest on the shelf. This model has molded transparent Lucite top and black base of the same material. Keystone Plastics also make all-transparent and all-black models for Carol Grey, the distributor

Plastics in Review

This year the Easter bunny brought candy packed in colorful plastic eggs, introduced on the market by Mrs. Steven's Candy Shops. The two-piece containers are injection molded of orchid, pink and white polystyrene by Eclipse Moulded Products Co.

A foursome that can be carried to the golf course or most any spot! Plastic Molding Corp. molds the cups for Richard A. Guthmann & Co. "Double Date Cups," as they are called, fit snugly into each other and then into a leather case. The cups are molded from urea

A Tom Thumb knife sharpener does a mighty job in the kitchen. Tenite II is used for the case which is injection molded in a 6-cavity mold by Modern Development Industries. They are produced with green, red and white housings

←The Jiffy Jigger Mfg. Co. has advanced the mechanical age with their jigger that measures and pours 1 oz. of liquid when a lever is pressed. The jigger is compression molded of Plaskon in 4-cavity dies

← Chipper chirpers cheerfully hold the candles on a birthday cake. The holders are injection molded in one piece of Nixon CA and Chemaco cellulose acetate. Bachmann Bros., Inc., are presently producing the birds in pink only

Double-duty is the by-word of this knitting bag. Closed, it is a convenient carrying case. Opened, the frame renders it self-supporting so that the bag can be set on the floor or a table to hold the knitter's necessities. The frame of the bag is fabricated of Lucite and has machine carving for a simple decoration. Metal screws hold the various parts together and act as hinges when opening and closing the bag frame. The fabric for pouch comes in colored rayons brocaded in gold. Alice Maynard retails the bag which is manufactured and also distributed by Royal Society, Inc. →

Grinding wheels developed by the J. G. Sandstrom Grinding Wheel Co., for deep-grooving metal, make use of Durez resins to bond the abrasive particles to the wheels. The resins were especially formulated to fit in with the size grain of the abrasive used, the temperature necessary for bonding and the pressure used in the process. The wheels, supplied in many sizes, grains and grades, have a guaranteed tolerance of $\pm$ 0.0005 in. The sides of the wheels are processed to insure a consistent overall radius →

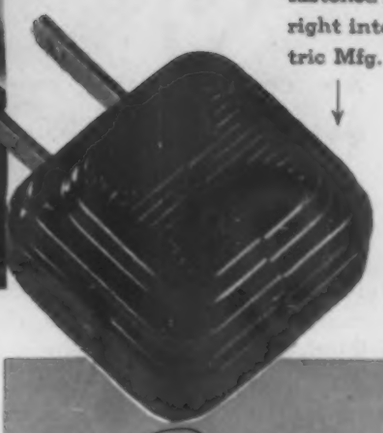
Back seat drivers have probably seen the mottled white coverings for taxi doors and seat backs. Designed to withstand scuff and hard wear, coverings are of sandwich construction, consisting of Melmac resin impregnated barrier and Kraft cores. Formica Insulation Co. does the laminating

← A treasure chest, sold with Gorham silverware, is this one covered with Terek, a cotton base material coated with pyroxylin. Athol Mfg. Co. makes the material which discourages tarnishing because it contains no sulfur

← Home owners might well consider a shade draw for every shade in the house. It goes beyond the decoration stage and becomes a means of protecting the shade where it is most likely to wear, tear and soil. Le-Fran Plastic Products molds and distributes the piece which is made of cellulose acetate and slips on from one end of the shade

← Pipe dreams come true with a molded polystyrene case that securely holds and protects pipes. Pioneer Pipe Co. distributes the case which will take the place of the wooden one they formerly made. Boonton Molding Co. makes the case by the injection method in a 2-cavity combination mold. A jig drilling operation is used to cut the hinge holes into which pins, for holding the two parts together, are inserted

No longer need the busy hostess wrestle with a stubborn ice tray to get ice cubes. The 12 compartments of the Jiffy-Cube ice cube maker, of formed ethyl cellulose sheet material, remain flexible at low temperatures and do not adhere to ice. Cubes may be removed separately by pressing the dimple on the bottom of the cup. The manufacture and assembling of aluminum tray and ice cube holders are done by Standard Products Co. for Plastray Corp.



Small but oh, my! This modern cube tap, which provides three electrical outlets, is molded of Bakelite, its two halves being fastened by a metal rod that screws right into the plastic. Eagle Electric Mfg. Co., Inc. makes the tap

Plastics in Review

The dainty dish that's set before a king, in this case, will be placed on a Kys-ite tray. Worthy of his highness, the tray has no tendency to splinter, dent or mar and is impervious to food and acid stains. Keyes Fibre Co. molds the tray for Wear Ever Baby Carriage Co., Inc. It comes in a serviceable neutral color

Fresh, clean and dry brushes are the aim of the Standard Product Company's toothbrush holder made of two plastic materials. The frame is molded of Tenite II in many bathroom colors and can easily be fastened to tile walls. The dome is of transparent polystyrene and has a top center hole which insures proper air circulation

Good mixers at the party are these Plexiglas muddlers for Old Fashioneds. They are hand fabricated by Judy Gilbert in Jewel-tone colors which will not wear off or fade. A bright future is predicted for these pieces because they have a sparkling beauty and they will not break

Rigid folded vinyl and acetate boxes

No cementing is necessary on these containers which are made up from flat die-cut plastic sheets folded so that the material supports itself

SOLID corners, reinforced sides, and ends if desired, absence of any cement or solvent are the features of a newly developed method of automatically forming boxes from cellulose acetate or vinyl sheeting. Introduced by the John H. Oxley Co., licenser of the process and builder of the equipment, the boxes have aroused interest because of the possibilities they offer for display and reuse.

There are almost no limits upon the sizes in which these boxes may be made up. At one extreme are ring boxes; at the other, containers large enough to hold a blanket. Color and rigidity also vary. Governed by the use to which the box is to be put, a customer may use .0075 to .040-gage plastic sheeting. But material of .015 gage is recommended for most applications. The colors of the boxes are limited only by the hues in which the plastic itself is produced. This selection is augmented by the combination of one color with another. Thus, a clear transparent bottom may have either a clear top, a red top, a green top or any of a multitude of colors. Or the top may remain clear and be used with variously colored bottoms. Again the top and bottom may be of the same or of different hues or shades.

With this wide variation in size, weight and rigidity (due to differing gage) and color, this method of forming boxes can be adapted to fit almost any merchant's needs—provided, of course, that his product or the display or reuse purpose for which he intends the box justifies the cost. Naturally, containers such as these cannot be made for the same price as the same sized paper box. But there is no expectation that the folded plastic box will be used interchangeably with paper containers.

Forming the boxes

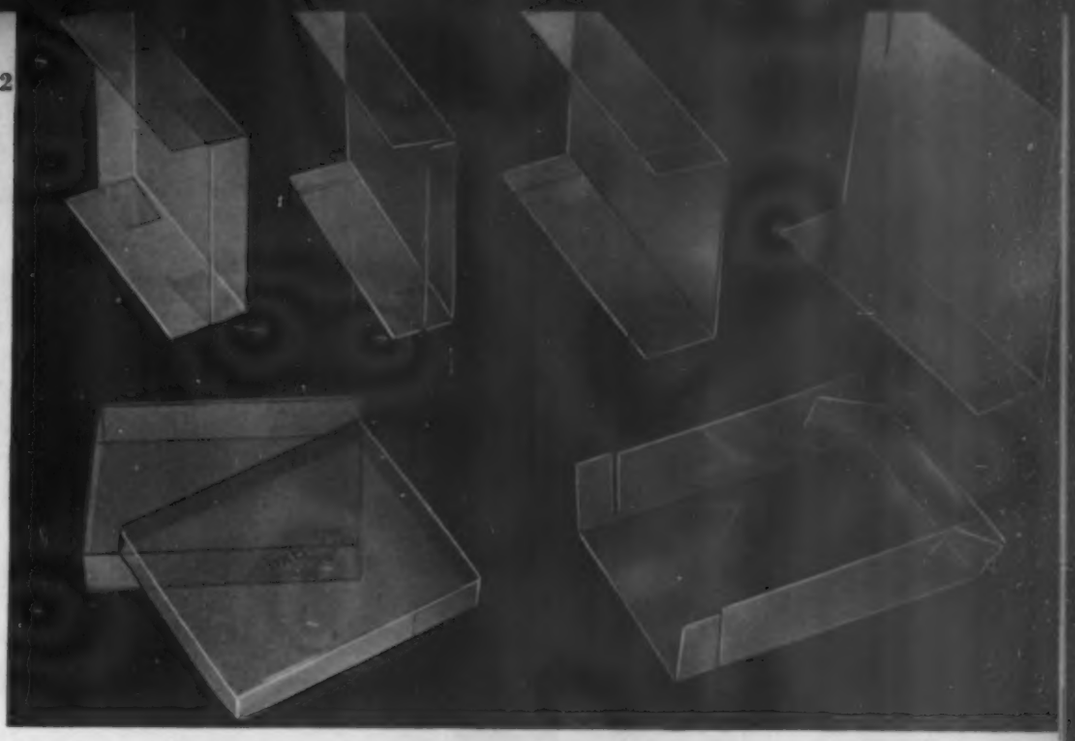
The folds in the plastic sheet and the equipment that makes these folds are the heart of this new boxing method. Almost as important is the solid metal die which permits the stamping out of almost knife-edge thin slots from the cellulose acetate or vinyl sheeting used for the boxes.

It is the position of these slots that determines the size of the finished box. Take, for example, a box bottom that is 5 in. deep and has reinforced sides but no reinforcement on the ends. A blank of the plastic sheet that has been cut to size is fed to the die cutter—600 of such blanks can be slotted in an hour. Four slots, 10 in. long and positioned 5 in. in from the sides of the sheet, are cut from the material. The slot must

PHOTOS, COURTESY JOHN H. OXLEY CO.

1—Protection, reuse and display combine in these rigid boxes that are made from cellulose acetate or vinyl sheeting and which require no cement or solvent to hold them together

2



2—In the folding of the plastic sheet by this newly developed means, there is no need of heating the entire blank. Instead it is heated only at the folds. 3—As shown, size, rigidity and color of these boxes are almost without limit—a fact that gives them a very wide scope of application

be 10 in. long to permit a double fold for the sides which give them two thicknesses of sheet. Since the ends do not have this extra support, there need be only enough material to make the 5 in. depth. The position of these slots and their length can be clearly seen above in Fig. 2.

By the same figuring, a 4-in. deep box would be slotted 4 in. in from the ends and the slot would be 8 in. deep. Should double folds be needed for both sides and ends—on a 4-in. box, for example, the slots would be made 8 in. long and set 8 in. in from the end.

The die stamping done, the slotted sheets are fed into the semi-automatic forming machine containing a knife-edge heater. With this equipment it is not necessary to heat the entire sheet of plastic for shaping, only thin lines where the actual creases are made. Thus, as the sheet enters the machine it is heated along the lines where the material must be folded up to form the sides. As it goes into the next position in the equipment the growing box has the appearance of the one shown second from the right at the top in Fig. 2. With the sides turned up, the material is again heated along the lines of the bends for the box ends. This operation gives a shape like that at the top left in Fig. 2. The second fold on the two sides,which gives the box the double reinforcement at these points, is made one at a time. First one folded up side piece is heated 5 in. in from the edge and bent over, then the other side is similarly treated.

While the bottom of a box is thus being formed, it is common practice to use another bench-type semi-automatic former to turn out matching lids. In this way box and lid can be matched up as production proceeds and there is no massing up of box bottoms until the equipment can be readjusted for the production of the lids. Instead there is a steady flow of box bottoms and lids which may be varied in color as desired.

3

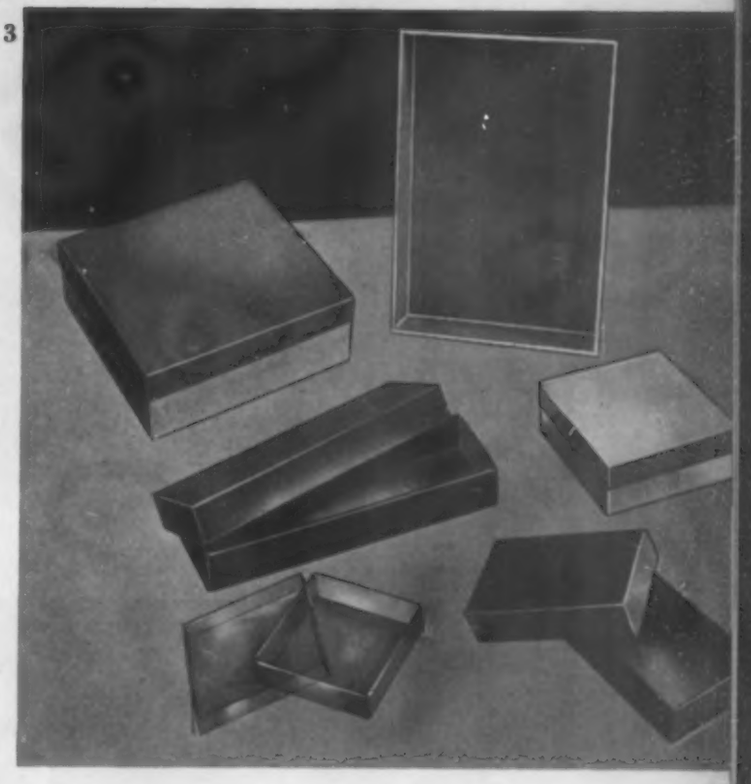
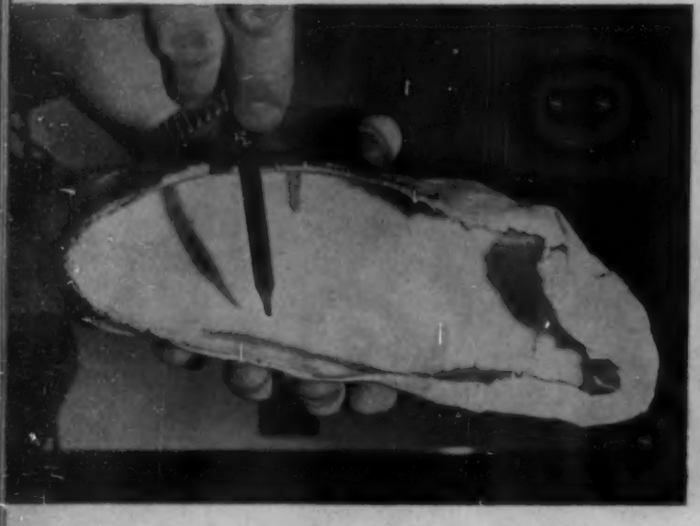


Figure 1 indicates the wide range of products for which these boxes already are being used. Except for the ring box shown in this picture, all these containers were primarily for display and were made with transparent tops. But there are others which have been designed to carry a sales message or a decorative pattern. Sometimes this is done before folding, sometimes after. Silk screening is sometimes employed to create the desired effects but hot stamping is also feasible. In fact, the full range of applications for these boxes is only beginning to be realized.

Molding

Glass fiber cloth impregnated with four different unsaturated polyester resins are formed under low-pressure into light, resilient arch supports

Immersing the plaster-of-Paris impregnated gauze splint in water is the first step in making the foot appliance



An inside view of the negative cast. From this cast a positive cast of the patient's foot is then made

A template is cut from resin-impregnated glass cloth. The positive foot cast is also a model for this operation

laminated foot appliances

AS shop clerks, factory workers and waitresses are all too well aware, the possession of a pair of perfectly normal feet does not necessarily mean that their owner can utterly disregard those tender members. Aching feet are aching feet, whatever the cause, and even the best of feet will complain if the demands put upon them are too great.

It has been found that such feet, though normal in all respects, need the support of prosthetic appliances for the prevention of occupational strain and also for those foot conditions which need correction for congenital or acquired defects. Indeed a technique has been developed by the Doctors Julius J. Gottlieb and Morris M. Gottlieb which may be used for any type of foot appliance, regardless of its shape or size.

Choosing the material

Finding the right material for this application was not easy, for like everything used by physicians and surgeons, it had to meet exacting requirements. It had to have strength and high dimensional stability and be easy to work with. The close contact which an appliance of this type has with the body meant that the material must also be non-toxic; non-sensitizing; chemically stable, so as to produce no harmful effect upon human tissue; unaffected by body acids and non-

PHOTOS, COURTESY OWENS-CORNING FIBREGLAS CORP.

Keeping the foot in the desired position, the moistened gauze splint is wrapped and shaped around the foot

After the negative cast, or shipper, has dried and set, the skin is pulled back and the appliance is removed

The cut-out piece of glass cloth is applied to the positive cast of the foot by means of cellulose acetate tape

The laminated appliance, still on the positive cast, is sealed in a polyvinyl alcohol bag and put in a curing oven

oxidizing. It could not absorb perspiration or odors. In order to determine the exact anatomical fit, it had to be possible to take X-rays of the foot in the appliance with no appreciable loss in the diagnostic quality of the X-ray plate. The appliance also had to be of a material that could be tailored to meet individual needs—rigid for active correction and support, or flexible for passive support; firm in the heel but flexible in the forward portion. It should not compress under deformity of the foot but should maintain constant correction and support where indicated.

It was found at last that molded unidirectional Fiberglas-reinforced low-pressure plastic laminates possessed the necessary qualities for the foot appliance. A combination of four Laminac resins was found to be most suitable impregnant for prosthetic appliances. At this time the American Medical Glass Co. was organized to make available to chiropodists and their patients the benefits of this new technique for molding the laminates into any type of foot corrective appliance. In the company's laboratories appliances are now fabricated to chiropodists' exact prescriptions.[1]

Casting the model foot

The chiropodist who wishes to have an appliance made for one of his patients makes a negative cast of the patient's foot by any of the usual methods of casting feet. Plaster of Paris impregnated roller gauze may be immersed in water and then wrapped around the foot, with the operator holding the foot in the desired position while plaster sets. Impregnated plaster-of-Paris gauze splints can be used and a cast of the foot made.

When the plaster of Paris has set, the skin is pulled away from the negative cast and the cast is slipped off the foot. This negative cast, together with necessary prescription data, is sent to the company where a positive cast of the foot is made.

Molding technique

An outline of the appliance to be made is drawn on the positive cast. From this a template is made which is used to outline the contours of the appliance on the uncured, resin-impregnated glass cloth. A sufficient number of plies of the material are used to give the necessary strength and thickness to the appliance.

A thin, flexible, strippable cellulose sheet is applied to the positive cast. The built-up laminate is then applied to this coated surface, being held in position with cellulose acetate tape.

The cast and laminate are inserted and sealed in an airtight bag of polyvinyl alcohol to which a valve is fitted. The bag and its contents are then placed in the curing oven. The valve is attached to a vacuum pump which exhausts the air from the bag. Depending upon the resin used, the curing time is 30 min. at a constant temperature of 105° C.

When the cure is completed, the polyvinyl alcohol bag is cut away, the laminated appliance removed from the mold and allowed to cool. It is then finished off on a sanding wheel, and checked by alignment with the positive cast. Any slight, but necessary corrections are made and the appliance, after being covered with a thin layer of leather, is ready to be given to the patient.

Besides their prophylactic use, the foot appliances are used for corrective treatment of both extreme and moderate flaccid foot, congenital flat foot, acquired flat foot and high arch foot.

[1] Archglass Foot Appliances, Patent pending.

A briefcase of nylon sheeting

A briefcase was one of the first applications for the new solid nylon sheeting which is now being manufactured in experimental lots by the E. I. du Pont de Nemours & Co., Inc. It is an appropriate application since the material is characterized by extreme toughness.

PHOTO, COURTESY E. I. DU PONT DE NEMOURS & CO., INC.

The nylon is made into a continuous strip of sheeting by being forced through a slot in a specially designed machine. If, as in this briefcase, a leather-like appearance is desired, the sheet is then passed through embossing rolls to get the grain effect.

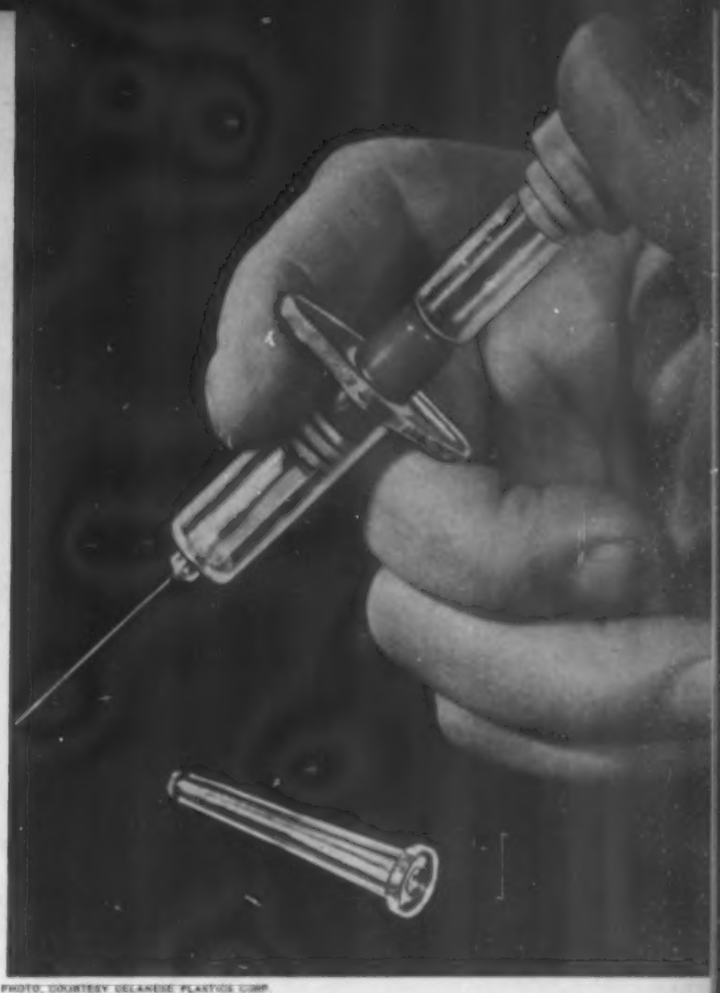
Nylon sheeting can be made in various colors and thicknesses. Besides being strong and flexible, the material is resistant to abrasives, heat and moisture, and to attack by insects or mold.

While the nylon sheeting is still in the experimental production stage, it is expected to be used for such purposes as seat coverings, panellings for trains, busses and airplanes.

Injection molded hypodermic for penicillin

High acetyl cellulose acetate is used both for syringe-type vial and guard of this needle

THE high-speed production methods characteristic of plastics, with resulting low cost of manufacture, have made possible the production of a new type syringe which greatly simplifies the single injection treatment of infections with penicillin since the complete instrument—needle, cartridge and all—can be thrown away after being used but once.



PHOTO, COURTESY CELANESE PLASTICS CORP.

High acetyl cellulose acetate is used for the syringe-type vial and the cover that insures sterility of the needle

The disposable molded syringe parts

This new syringe, which is being distributed by Abbott Laboratories and a number of other companies, consists of a disposable glass cartridge containing a 1-cc. (300,000 units) dose of a sterile suspension of calcium penicillin in a mixture of peanut oil and bleached beeswax, and a syringe-type vial with a fixed needle which is also intended for disposal after one application. There is, too, a transparent guard that fits over the needle, keeping it sterile prior to use.

Both the syringe-type vial and the needle guard are molded of Lumarith X, a material which was chosen for its easy moldability, dimensional stability, resistance to chemicals and to low heat sterilization and also for its great clarity.

The first named property of this high acetyl cellulose acetate—easy moldability—is of special importance in this case since the instrument involves such delicate parts as a hypodermic needle. It would be disastrous should the plastic damage the needle as it enters the mold for the vial where the needle is used as an insert. This needle insert, incidentally, is made with a slight bend near its base to insure the firm anchorage of the needle in the plastic.

These vials are turned out in 8-cavity molds which operate on a 50-sec. molding cycle—20 sec. of which are used for the placing of the needle inserts. All that remains is to remove the parts from the mold and degate. Since the gates and runners can be broken off with considerable ease, handling of the finished parts is held to a minimum—always an advantage where fragile molded parts are concerned.

Factory sterilization

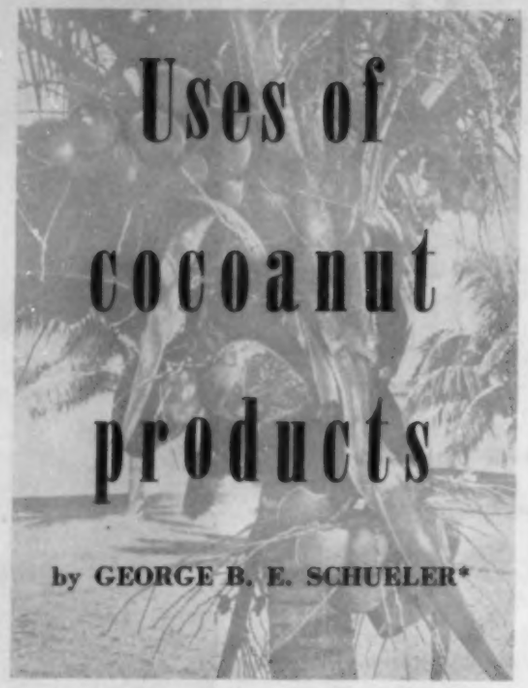
An interesting and important feature of these new syringe sets is the way in which they are sterilized in the factory, thereby eliminating the necessity of further sterilization just prior to the use of the needle. When the molded parts are delivered by Presque Isle Plastic Co. to the instrument firm, the molded plastic guard is placed over the needle and the entire assembly sterilized by means of low heat and chemicals. The guard fits snugly enough to maintain this sterilization until the needle is used.

Development of treatment

Since the suspension of calcium penicillin in a mixture of beeswax and peanut oil was originally developed by Captain M. J. Romansky of the Walter Reed General Hospital, its use has been extended to the treatment of such infections as pneumonia, impetigo and staphylococcus. The fact that the entire syringe set can be disposed of after each treatment is an added insurance that the various infections will not be spread from one patient to another. Then, too, hospitals find that this new hypodermic for penicillin saves time—the patient's, the doctor's and the nurse's.

Uses of cocoanut products

by GEORGE B. E. SCHUELER*



Cocoanut shell flour, as a filler, gives a smooth finish and improves both moisture and heat resistance

THE proper use of the most advantageous fillers in plastic molding will to some extent determine the future competitive power of this industry as compared to other industries. The amount of filler and type of filler used affects the cost of the product, but to what extent depends on the nature of the filler and the type of resin, as well as the physical structure of filler and method of its incorporation.

A filler may be processed to give long or short fibers, high or low absorption and other qualities. Any filler can be termed "good" if it is in abundant supply, if it involves the use of less resin, if it will not harm the dies or molds, if it will reduce the cost of the finished article or if it will improve properties which are found in the molding compound.

Flexural and impact strength of a molding will be better if there is homogeneous distribution of filler and resin in the structure, and if the two bond well—which can be best assured when the filler itself already contains a binder material such as lignin. Good interlocking of the fibers is also important, as well as density of the filler.

Today increasing amounts of cocoanut shell are being used in this country as a filler for plastics due in part to the shortage in supply of walnut shell flour. The outer portion of the cocoanut consists of a relatively thin leather-like outer husk (epicarp or pericarp) and a thick fibrous layer (mesocarp); together these account for about one third of the nut. A dense strong shell (endocarp) of approximately 1/8 in. thickness accounts for a further 10 to 15 percent of the weight and the kernel (endosperm), which in dried form is copra, makes up (together with the milk) the rest of the weight, i.e., approximately 50 percent. The main product of the cocoanut is the kernal (copra). As a by-product in its manufacture the cocoanut shell flour occurs which we are considering here as a filler for plastics.

Availability and use

The fibers or coir from the cocoanut shell are used for making rope, mats, brushes, etc., but since certain grades only can be used for these products, some surplus fibers remain. In the spinning and matting of the longer fibers there occur as by-products combings, clippings and dust. Therefore, the cocoanut industry can supply three fillers for plastic: cocoanut flour from the shell itself, coir dust and fibers of different lengths and quality.

Supplies of cocoanut shell are almost unlimited, the production of shells in 1939 exceeding 3 million tons, 25 percent of which came from the Netherlands East Indies, 22 percent from the Philippine Islands, 18 percent from British India, 9 percent from Ceylon and 8 percent from Malaya.

Naturally, the shells are available economically only if collected as a by-product from copra or oil production. Only if transport and fuel, other than cocoanut shells, are available to the growers and home driers, can the shells be exported.

Because molding powder manufacturers require a material of uniform fineness, composition and purity, strict technical supervision at the source will be required. Grinding, sifting, transport charges and losses of material in this operation will influence the price, but in spite of the distance the material should become important as a filler by virtue of the valuable properties it imparts to moldings.

Cocoanut versus walnut shell flour

Cocoanut shell flour gives molded articles a smooth and lustrous finish. It requires less resin to bind the mold compound than most other fillers; it improves resistance to moisture and heat. It gives moldings the dielectric strength provided by walnut shell flour.

The following table compares composition (dry basis) of walnut and cocoanut shell, and shows their similarity.

	Walnut shell flour %	*Cocoanut shell flour* %
Hot water solubles (starchy materials, sugar, etc.)	2.20– 2.50	2.67
1% NaOH solubles (pectins, gums, etc.)	13.10–14.80	20.53
Alcohol-benzene solubles	2.10– 2.49	...
Ether	0.16– 0.28	0.19
Alcohol (95% for 4 hr.)	2.30– 2.56	...
Ash content	0.38– 0.53	0.23
Cutin	1.70– 6.30	...
Lignin	26.00–32.10	33.30
Furfural	5.20– 5.50	...
Pentosans	8.90– 9.30	17.67
Methoxyl	6.30– 6.50	5.40
Cellulose	59.60–60.00	61.00

* Consultant on the application of plastics, waste fibers, London, England. Researches in this article conducted on behalf of J. H. Vavasseur & Co. Ltd., London & Ceylon.

Table 1—Properties of Phenolic Molding Compounds Made with Cocoanut Shell Flour[a]

Property	*Material 1 100 Phenolic resin/- 100 cocoanut flour*			*Material 2 50 Phenolic resin/- 100 cocoanut flour*			*Material 3 100 Phenolic resin/- 100 woodflour*		
Flow	5			8			12		
Cure, sec.	70			60			62		
Powder density	0.63			0.68			0.60		
Reflection, cm.	3			3			1.5		
Specific gravity	1.25			...			1.35		
Shrinkage, percent	1.09			0.96			0.83		
Water absorption, mg.	52			109			86		
Increase in diameter, in.	...			...			0.0008		
Increase in thickness, in.	...			...			0.0006		
Impact strength,[b] ft./lb.	0.21			0.20			0.17		
Tensile strength,[b] p.s.i.	5200			9000			8000		
Plastic yield at 140° C., mm.	4.9			2.3			4.3		
Acid absorption (H_2SO_4, Sp. Gr. 1.25), mg.	28			43			...		
	A	B	C	A	B	C	A	B	C
Surface resistivity									
Before immersion, 10^5 megohms	1.45	1.5	1.5	1.15	1.15	1.7	1.3	1.15	1.15
After immersion, 10^5 megohms	0.09	0.086	0.1	0.2	0.74	0.074	0.41	0.48	0.37
Volume resistivity									
Before immersion, 10^5 megohms	6.0	6.6	11	3.9	5.4	5.2	1.9	0.61	0.61
After immersion, 10^5 megohms	3.5	0.40	5.8	1.1	1.2	1.3	0.35	0.32	0.32
Electric strength at 90° C. (breakdown), v./mil.	103	115	96	73	80	61	43	53	45

[a] The properties were determined by the test methods described in British Standards Specification B.S.S. 771.
[b] Conditions for specimen preparation: preheating time, 15 min.; preheating temperature, 100° C.; mold temperature, ca. 155° C.

Walnut shell—Cutin content on the average about 5 percent. The fact that 33.8 to 39 percent of this material is not dissolved in concentrated sulfuric acid (72 percent) is an important factor to consider in many applications.

Ash (0.38 to 0.53 percent) contains calcium, potassium, phosphorus, magnesium. Specific gravity: 1.35 to 1.45. Weight of fine walnut shell flour: 29 to 31 lb. per cubic foot.

Cocoanut shell—The yield of lignin, total pentosans and pentosans in the cellulose are higher in shells than in hard woods, but the percentage of cellulose, cellulose stable to hydrolysis in 15 percent sulfuric acid, and holocellulose are considerably lower than those for the woods.

Lignin being present to the extent of 33 percent means that less resin should be required. At the same time the fact that the shell flour does not absorb resin but binds exceptionally well constitutes a further saving in resin. The high density of the material (cocoanut shell ground to 150/200 mesh has a density in powder form of 0.7 to 0.75) makes it especially welcome for certain purposes. Ether extraction has proved that cocoanut shell flour contains no oil; this being achieved through careful inspection of the shells before they are pulverized in order to avoid the inclusion of copra.

Coir dust

Experiments with coir dust as filler have not yet advanced to the same extent. It is much more highly water absorbent than are the fibers and it parts with the water very slowly. It is 20 percent lighter than woodflour and has given experimental moldings a brittleness when it was the only filler used with the resin. It would have advantages in combination with a compact, non-absorbent filler which can be used for certain purposes.

Fibers

Applications in the plastics industry for cocoanut shell fibers have been few, but in India they have been used with shellac as a binder. Hard coir fiber boards are made by beating the coir into a fluff, clipping into small pieces—of 0.5 to 1.0 cm. in the disintegrator—then treating with a solution of shellac in ammonia which is dried. It is then mixed with twice boiled linseed oil and exposed to the sun for 4 hr. to promote partial oxidation.

After this operation it is pressed at 130° C. with half a ton per square inch pressure. It is finally baked in molds for 30 minutes. The boards are very hard and have a good finish. It can also be made in the form of molding powders.

There should be other methods of using coir products and producing a stronger and homogeneous product, since it is readily available and needs only the addition of economical binders to produce a product with high tensile strength.

1

Earrings that act as hearing aids

A molded acrylic ear insert acts as a sound conductor and a base for earrings

WOMEN are particularly sensitive about wearing hearing aids. Many hard-of-hearing women have hesitated to avail themselves of these valuable instruments because of the attention called to their difficulty by the customary type of receiver which protrudes from the ear. They fear that it might work to their disadvantage in business activities.

One of the most original and practical solutions yet devised for this problem is a new type of receiver unit known as Hear-Rings. Evolved by The Maico Co., Inc., Hear-Rings provide concealment of a powerful ultra-midget receiver within an attractively styled, jewelled earring. This revolutionary development is made possible by the incorporation of a minute Lucite insert, individually molded to the user's ear and so precisely formed that it is practically invisible in use. The insert, firmly fastened to the ear clamp, extends from the ear canal to the receiver, which is worn on the ear lobe.

The small disk-shaped receiver to which the insert is attached, forms a base over which a fashionably styled piece of costume jewelry is clamped to complete the earring. The type of construction employed enables the wearer to vary the style of the earrings by changing these decorative components at will.

The non-receiving unit, worn on the unfitted ear, is a dummy replica of the receiver, having a lightweight base of either flesh colored or black phenolic material on which a matching piece of jewelry is clamped. If the degree of deafness so requires receivers may be fitted for both ears.

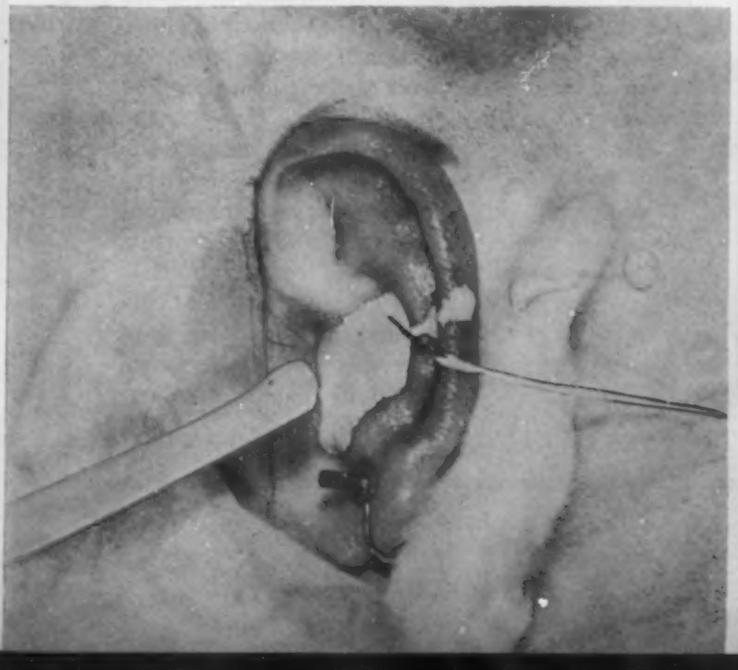
When the Hear-Rings are in use, the cord from the receiver unit is passed behind the ear and through the hair at the back of the neck, extending into the neck line of the wearer's dress to the compact, concealed microphone. The unique hearing aid may be slipped on in the morning and removed at night as easily as a pair of earrings.

Of particular interest and importance is the method followed in fitting the tailor-made insert to the ear of the user. Of transparent

5

1—The first step in the molding of acrylic ear piece, to which dummy earrings are attached, is the positioning of the earring clip. 2—Taking care that the clip is not disturbed, the patient's ear is partially filled with cotton to protect the ear drum from the mold material. 3—Next comes the pouring of the plaster from which the impression of the ear canal is made. 4—The plaster mold is carefully built up around the ear lobe and the clip screw. 5—It is from this finished mold that acrylic insert is made by a special process

3 PHOTOS, COURTESY MAICO CO., INC.



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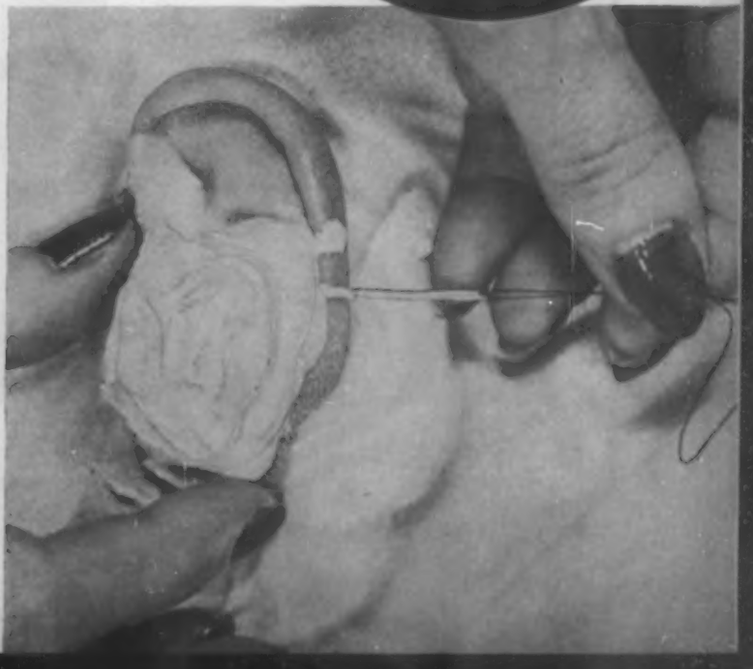


white Lucite, the insert spirals to conform to the contour of the ear canal and the lower portion of the outer fold of the ear. Proper functioning of the instrument depends largely upon an accurate fit. The insert protrudes about 1/2 in. into the ear canal and fits closely down the side of the ear lobe behind the receiver disk, to which it is attached by a sturdy metal fastener.

In order to insure correct fitting of the insert, a plaster mold must first be made. A dummy earring is fastened to the patient's ear and the disk carefully removed, leaving the earring clip in the exact position in which it will be worn. After suitable preparation of the ear, including the insertion of a cotton tampon into the ear canal, plaster molding material is poured into the ear. The ear is filled with plaster and the mold is built up around the ear lobe and clip screw.

The finished mold, after hardening, is withdrawn from the ear with the earring clip firmly embedded in position. By means of a confidential process, and utilizing the plaster case for a pattern, Twin City Ear Mold then produces the finished Lucite insert. The earring clip itself is embedded in the plastic material during the molding procedure. Other plastic components of the hearing aid are made by The Maico Co. on its own molding equipment.

The completed Hear-Rings, whose special features depend upon the versatility of plastic materials, promise to be a boon to many women who, although impaired of hearing, have hesitated to turn to hearing aids because of esthetic considerations.

A new surface lacquer for polystyrene

The ever-popular polystyrene is apt to have even more enthusiastic backers now that a special lacquer for coating its surface has been developed.

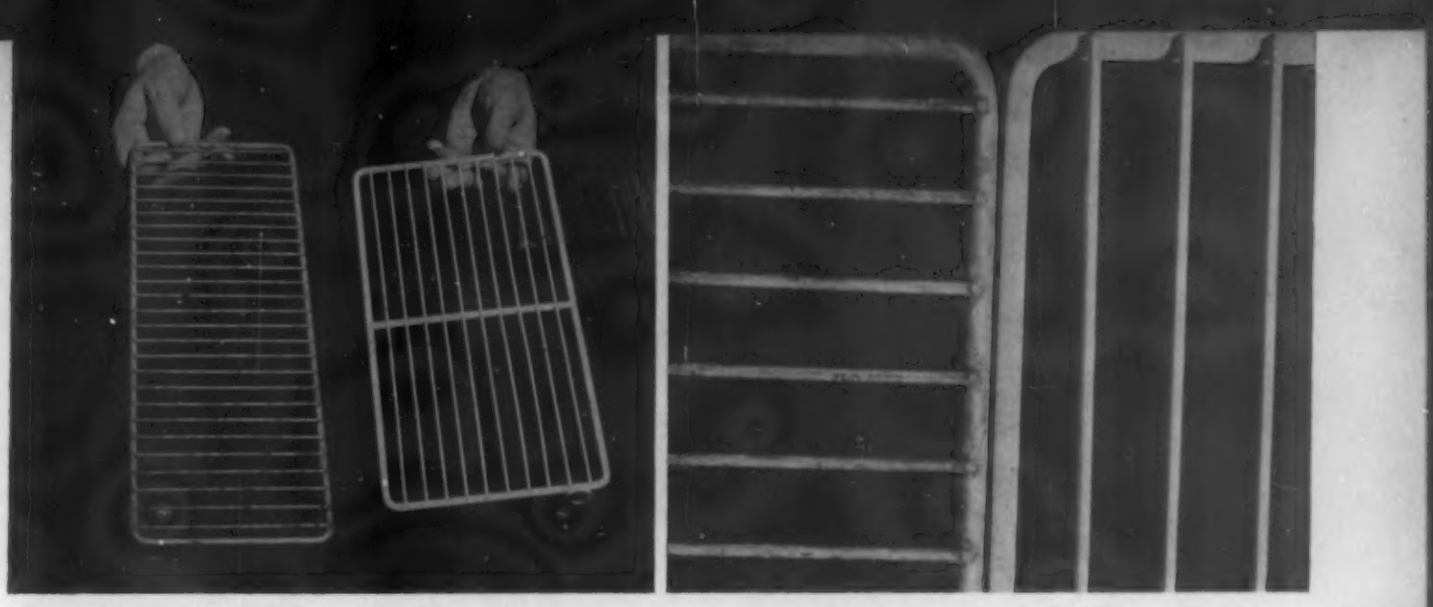
The laboratories of Roxalin Flexible Finishes in developing a new lacquer at the request of refrigerator manufacturers had several obstacles to overcome. Since polystyrene is used extensively for such refrigerator interior parts as freezing compartment doors and temperature dials, the lacquer had to withstand humidity and low temperatures. Because polystyrene is thermoplastic, no high-temperature baking system could be used, so an air drying enamel was indicated. To meet production line speed, the coating material must flash off in a matter of minutes. To adhere properly to the smooth surface, the coating must etch only slightly.

By formulating the coating with a lacquer base whose properties meet the necessary exposure requirements and which will adhere to the surface of the polystyrene without harming it, an excellent enamel for spray decorating the material was developed. The new lacquer not only meets the refrigerator specifications but is characterized by resistance to soap and food acids, fastness to ultraviolet light, resistance to cracking and peeling, toughness and good luster.

The refrigerator parts shown in the accompanying photograph are typical of polystyrene moldings that have been decorated with this new coating. The pieces were produced by Standard Products Company. The two small disks in the right-hand corner contrast the results obtained from conventional and this new lacquer. The disk on the right is the one coated with the specially developed lacquer.

In many plants it is not practical to use spray equipment, particularly for filling work, so it was found necessary to formulate another lacquer to use especially for wiping-in applications. Many firms prefer this application because it is less expensive to tool up and the method uses less enamel and eliminates masking.

The wipe-in lacquer like the spray lacquer has good resistance properties but it is designed to be used with such simple tools as brush and dropper. It is simplest to apply the coating in droplets on the surface of the article and when too much is dropped it can be wiped off with a solvent, developed for the purpose, and there is no danger of smutting surrounding areas. Both lacquers are made in a variety of standard colors.



Refrigerator trays, coated with an alkyd urea-formaldehyde solution, were subjected for 1000 hr. to 100 percent relative humidity and showed considerably less rustiness than tin plated trays (left-hand side of both pictures) which were subjected to the same amount of humidity for only 24 hours

Better wear for refrigerator trays

FOR the past 5 years research engineers at Servel, Inc., have been working to perfect an organic finish and a process for application which would overcome the bugaboo of rust that characterized the hot tin-plated shelf used in almost all prewar ice boxes. The finish coming out of this work, which gives a gleaming all-whiteness to the inside of the Servel gas refrigerator, is a coating of a urea-formaldehyde modified alkyd synthetic resin, with base coats of zinc and Bonderite. Shortages of tin for plating hastened the research for a new finish, and the result, which is now on the market, is a plastic-coated shelf with inspection specifications far stiffer than those ever applied to the tin-plated shelf of time gone by.

Previous to the war, the only test of tin-plating was that the shelf had to be able to take 24 hr. of 100 percent humidity at 110 to 120° F. According to Harold R. Lyon, organic finishes engineer, who runs the Organic Finishes Laboratory in Servel's Engineering Department under Mr. A. C. Shuart, assistant chief engineer, this test was a veritable pink tea party compared to the grueling specifications set out for the new plastic food shelf finish.

"In the field of moisture resistance, we increased our requirements to quite an extent," Mr. Lyon said. "Instead of the 24-hr. testing period, the new finish must stand up for 1000 hr. under conditions of 100 percent relative humidity, at 110° F., without any evidences of breakdown.

"As for abrasion resistance, the new plastic finish is subjected to a minimum of 1000 wear cycles without wearing through the top plastic coat. This test is made by a mechanical moving arm which rubs a filled pint milk bottle back and forth in the same path.

"Flexibility must be high also. The finish shall not show hairlining, cracking (*Please turn to page 204*)

After the refrigerator trays receive a zinc plating and a coat of adhesive, they are run through dipping tanks containing the synthetic resin solution. In the heat treatment that follows, trays attain a glossy finish

Acrylic and Acetate in the ICE FOLLIES

1—*Large translucent acrylic sheets form the points of this huge star which is the center of interest in the "Celestial Ballet" number*

Famed traveling ice show puts plastics on ice in $150,000 worth of spectacular props and scenery

BARNSTORMING on an elegant scale—17,500 miles a year, 17 cities from coast-to-coast, 350 performances—that's a real measure of endurance. Add the rough treatment encountered in frequent handling, repeated packing and shipping, the extremes of temperature ranging from the cold of a frozen rink to the high heat of Kleig lights, the excessive moisture resulting from the ice, and you have a practical test of plastics. Almost $150,000 worth of scenery, props and costume accessories, consisting principally of plastic sheeting, meet these conditions in the traveling Shipstads & Johnson Ice Follies Show.

Now in its tenth season, the colorful musical revue on ice represents big business with its huge cast, technical staff and its annual investment of almost a half-million dollars in costumes, scenery, etc. While plastics were used to some extent in several of the company's previous reviews, the 1946 edition contains a host of applications. To quote Bert Lundblad, stage manager of the show, "We could use plastics in a thousand places if we knew more about them!"

Price is of minor concern to these showmen. The plastic props cost anywhere from $1500 to $15,000, a sum which includes the other materials used with the plastic and, of course, labor. The management likes plastics because they lend themselves to spectacular color presentations and to intricate forming, are light in weight and require a minimum of maintenance.

Acrylics for the five point star

The "Celestial Ballet" number in this show is almost entirely dependent upon plastics for its props. The center of interest is a huge translucent acrylic five-pointed star, approximately 30 ft. in diameter when complete (see Fig. 1), which is assembled right on the ice. Each point of the star is a separate unit 13 ft. long, activated by a motor, with four forward and four reverse speeds, concealed beneath the frosted acrylic sides.

The clear acrylic sheets comprising the sides of the star points are painted on the inside and fitted into a metal frame. The seams are covered by metal stars affixed to the surface of the plastic. Acrylic is also used for the half-moons mounted atop the base.

With a girl at the steering and control wheel, the points are driven around over the ice for a time and finally guided to a circular base having five openings which receive the heavy ends of the points. Light is directed from this base into the star points. At the

end of the scene, a revolving chandelier formed of engraved plastic sheet is lowered into position, and the sparkling plastic reflects the lights of varied colored spotlights which are directed on it as it turns.

In the sophisticated "Romantic Hour" number, eight skaters wearing luxurious blue fox stoles primp before huge dressing tables. As can be seen from Fig. 3, each table has a fluted cellulose acetate base and impressionistic featherlike top and sides. There is a plastic stool to match. These plastic sections are deep drawn from clear sheet, then sprayed with pink on the reverse side. The picture frame on each table, made in the form of a valentine, is of acrylic.

Acrylic skating rink and orchestra stand

A rather startling use for acrylic sheet is the top of a small, round table upon which one of the performers skates. "Naturally, it scratches," reported the stage manager, "but it doesn't nick like enameled wood and lasts a good many performances before requiring replacement. Best of all, it *looks* like ice.

"For the very same reason, we cover the entire baseboard around the outside of the rink with acrylic sheet. Even with abuse it still sparkles and is 100 percent more attractive and durable than painted wood."

Another major use of plastics is in the central stage set—a permanent orchestra frontispiece which remains on stage throughout the entire show. Here huge fluted columns, 9 ft. high, are formed entirely of opaque acrylic sheet and illuminated from the rear. Scrolls of the same material adorn the top. In spite of the fact that these units remain on the ice even between shows, are steadily illuminated during each performance and, are bumped by props and skaters moving on and off stage, they have managed to resist heat, cold and abuse so as to demand a minimum of repair work.

Costumes sparkle with plastics

Many of the costumes worn by the skaters in this review display a lavish use of plastics. There are dramatic but featherweight hats, brilliant trimmings. And waterproof resinous sprays are applied to protect long skirts which drag on the ice. In the "Fantasy in Gold" sequence, each skater wears an accordion-type arm piece, made up of gold-painted plastic strips, hinged at the elbow so that it becomes a dazzling gold fan when the arm is raised. "Even if they do cost $95 a pair," the stage manager reports, "the same effect just couldn't be achieved with anything else. Any other suitable material would be so heavy the girls couldn't lift their arms."

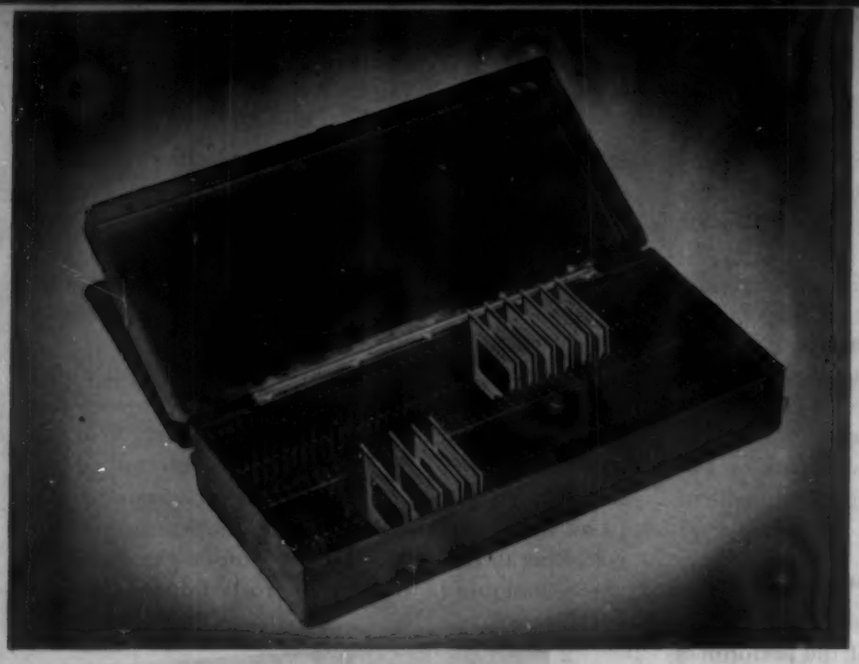
At present, Plexiglas, Lucite and Lumarith are the principal plastics used in the show and most of the actual fabrication has been by Studio Props, of Burbank, Calif., theatrical and motion picture scenery builders. However, the Ice Follies' management plans to set up an experimental plastics fabricating shop and is looking to the plastics industry for new materials and new techniques to dress up its frosty fantasy.

2

PHOTOS COURTESY SHIPSTADE & JOHNSON ICE FOLLIES SHOW

3

2—A close-up of a skating star in front of an ornate dressing table with feathery top and fluted base formed from cellulose acetate sheet. Picture frame and stool are also made of this material. 3—Eight performers shown in front of the luxurious setting



THE REDESIGN of this 35 mm. Kodachrome slide box molded of cellulose acetate and produced by Manhattan Screw Co., is the old story of the metal part being to blame, rather than the plastic one.

The old-type slide box was designed to be assembled by means of a standard hinge having a spring clip in its center. The hinges were first put into molded slots in the side of the bottom of the box, making for poor assembly.

The fault of this design, it was soon discovered, lay in the fact that the cover was too heavy for this type of hinge. When the cover opened up, the snap of the spring plus the weight of the cover would frequently pull the hinge out of the bottom slots.

In going about the redesign of the molding and assembly job, the manufacturer finally decided that piano type hinges with no spring would be the best choice for this particular plastic application. This new hinge is applied to the bottom and the top of the box with drive screws. The company reports that it has yet to hear of a single failure in the case of the new assembly.

The molding of the slide box is done by Jersey Plastics & Die Casting Co., who use Bakelite material in a two-cavity semi-automatic type mold on a 300-ton standard injection molding press. A molding cycle of $3^1/_4$ min. and a cure period of $2^1/_2$ min. are employed for this operation.

PLASTICS

THE WORLD in slightly reduced size is reproduced on a 50-in. diameter globe which Air Age Education Research has developed using fabric laminated with cellulose acetate.

To produce the spherical base for the map, cloth coated with cellulose acetate is laminated on a plaster form in the shape of a half globe. After five or six successive layers are built up in this way, the lamination is allowed to set and when thoroughly dry is removed from the form. Czecho-Peasant Art Co. makes the globe with $^1/_4$ in. thick walls.

The halves of the globe are next sent to Weber-Costello Co. where the paper map is mounted by experts in a delicate hand operation. For facility in handling, the paper is glued on in narrow sections.

When the map is in place the two pieces of the globe are returned to the plastic company for assembly. A cellulose acetate coating protects the paper from scratching or discoloration and makes it possible to write on the globe and wash the marks off later.

MIXERS for malteds and milk shakes are produced of Tenite in a deep draw injection molding process by Plastic Industries, Inc., the designer and molder of the article.

The large mixer cups, measuring $6^{3}/_{4}$ in. high, with a 4-in. opening at the top which tapers to $2^{3}/_{4}$ in. at the bottom, created a problem for the molder because of the unusually deep draw involved. So that the molding could be removed from a standard 8-oz. injection machine with a mold opening of from 8 to 10 in., it was necessary to design a special hinged and movable core. The gating of the part on the bottom directly from the sprue, made possible the elimination of the work involved in trimming the top bead and the consequent buffing.

The sidewall of the cup is of sufficient thickness to give the piece strength aside from that imparted by the top bead and to give it a sturdy feel. External and internal ribs molded in the sides prevent the cups from sticking together when they are stacked. The internal ribs also act as baffles during agitation in mixing machines.

Being plastic, the containers do not have a tendency to frost and sweat and leave moisture rings on the table. The insulating properties of the cellulose acetate keep the contents cool and prevent the cups themselves from becoming unpleasantly icy on the outside. The pieces are lighter than metal cups.

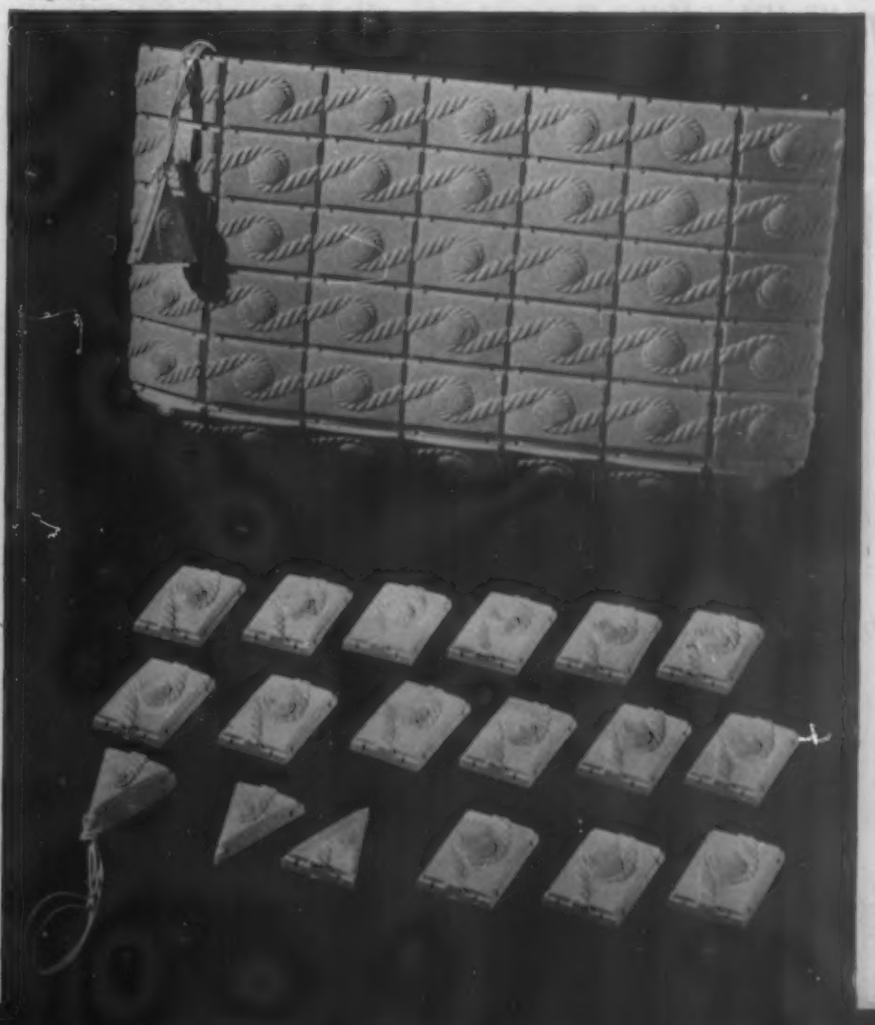
PRODUCTS*

* Reg. U. S. Patent Office

THE DESIGNER bagged a sure one with this plastic handbag suited equally well for marketing in art and needlecraft or ready-made departments.

Blocks injection molded of ethyl cellulose or cellulose acetate by Commonwealth Plastic Co. or Plastic Industries, Inc., are fastened to each other at the four corners with plastic thread composed of Pliofilm which has been further processed by Iona Fabric Mills, Inc. Future plans of Kaplan & Gordon Corp., the designer and manufacturer, tentatively include a plastic lining.

As it is supplied in handicraft departments, the U-Make-It bag comprises a set of the rectangular plastic blocks, each with a scroll design and holes for threading; six triangular pieces for the handle of the zipper cord and for the bottom corners; and sufficient plastic thread to do the job. Assembly of the unit is said to be simple enough for a child to accomplish without much difficulty. So far the handbag is available in red, white, black or navy.



COMPACTNESS and versatility are keynotes of the all-in-one cellulose acetate handled tool kit which is manufactured by the Standard Pressed Steel Company.

Injection molded of Lumarith, the hollow red handle serves as a housing for the assorted metal bits. A screw top of black acetate closes the container, completes the handle and attractively compliments the bright red color of the molded plastic tool body.

Ridges molded in the acetate of the handle afford a firm even grip, while the non-conducting properties of the plastic make the tool a safe one for use on electrical installations. Even used by grimy hands, the handle stays clean and glossy in appearance, rather than becoming stained and unsightly. And the acetate is sufficiently tough to withstand hard use.

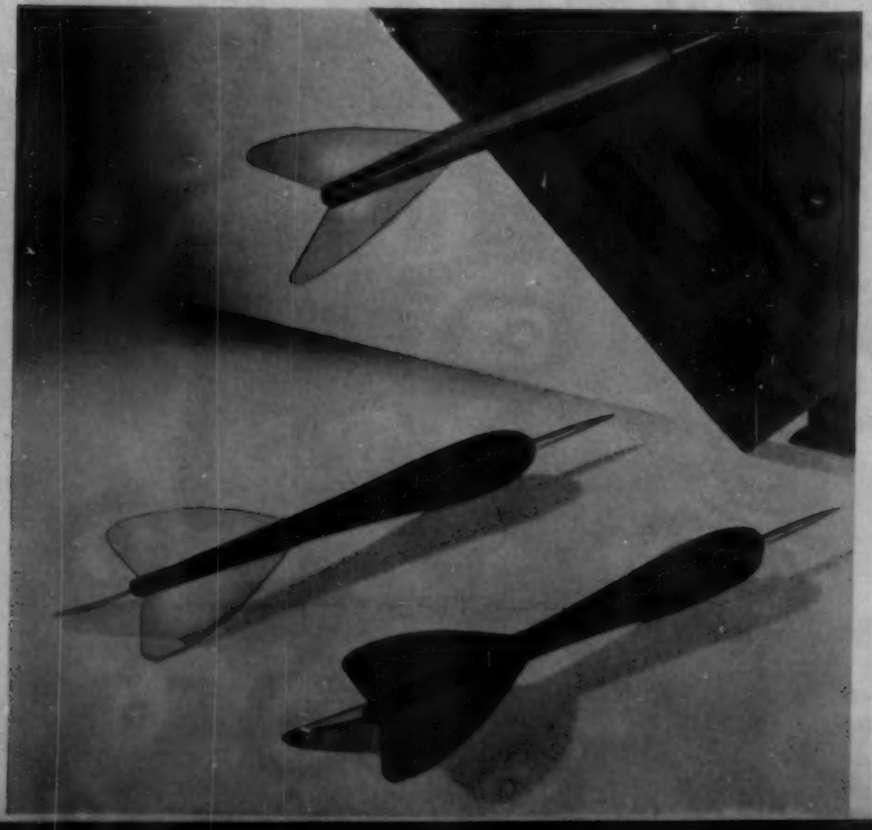
The design of the set, known as the Hallowell Speed Tool Kit, is such that bits housed in the handle can be quickly removed and inserted into the steel chuck of the tool. The chuck is of swivel construction so that it can be easily snapped into any one of five positions for effective operation.

The tool kits are supplied for various needs, those already produced including special sets for home use or for auto.

PLASTICS

THE AIM of Moldall Plastics, the company designing and producing these plastic darts, was to make a set of projectiles that would have accurate tru-flight and yet be both durable and attractive.

To do this they took hardened steel inserts weighted with lead and, with these as centers, molded the bodies of black cellulose acetate or colored ethyl cellulose in a series of 10-cavity hardened steel molds. Next the plastic parts were removed from the sprue and placed in special grooving machines which simultaneously made three grooves 120° apart and about $^{1}/_{16}$ in. deep at the tapered end. Colored fins were then cemented into the grooves to provide stability while the darts are in flight.



The fins themselves are produced in punch press dies from sheets of transparent Nitron, chosen for its bright coloring, relative stability and compatibility with solvents.

The production of the dart body by this molding method has many advantages. For instance, there is no flash, hence no cleaning operation and no forming or turning which might mar the smooth surface. The process also allows each dart to be made identical in color, weight, surface finish and taper. The minimum of operations required makes for considerable saving in time.

LOVELY legs to speed the sale of lovely stockings are produced of plastic by Shoe Form Co., Inc. Called Fairy Forms, the shapely display pieces are molded of Fairylite, a material that has been found to show fine hosiery off to good advantage and to be lightweight and durable.

Purchased in tube stock from several suppliers, the plastic material is cut to the proper length and tempered, then placed in a mold, the inside of which conforms to the shape of the original model and is gaged to the thousandth part of a size. After processing with steam, air and water, a form which will exactly fit women's size 9 results.

Due to the present day popularity of sheer hose, it is important both that an extremely smooth finish be produced and that the forms be seamless. Considerable hand work is necessary to obtain this satiny surface. When colors are to be used, they are applied by means of a spray finish which becomes part of the material itself. For displaying different types of stockings and for various effects, the forms are furnished in three shades, the transparent style serving to bring out the minute details of the more expensive stockings, Neutra-Tone allowing the true color of the hosiery to be shown and Glamour-Glo adding warmth to the more delicate shades. Great care is exercised in packing for shipping so that the finish may be unimpaired.

Employing a subtle sales psychology, the hosiery forms are designed with idealized contours which focus attention not on themselves but on the color, sheerness, fashioning and allure of the hosiery which they model.

Most of the forms have a patented weighting in the toe which supports them in perfect position without further aid. Some, however, can be had with a separate matching or contrasting plastic base which holds the form in a graceful tip-toe position.

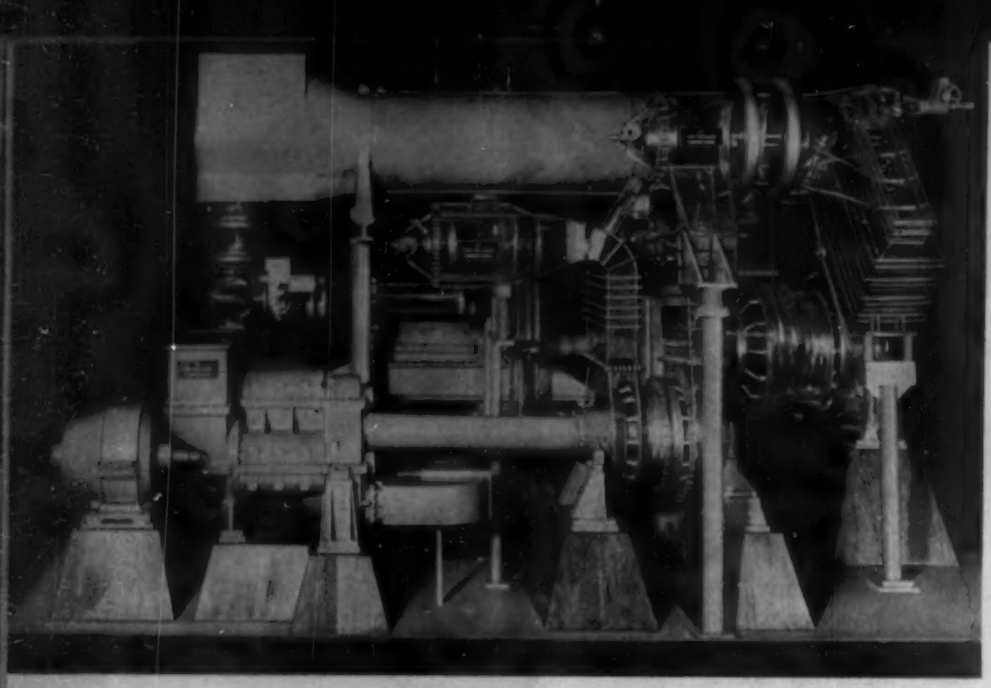
PRODUCTS*

WHEN the toddler goes for an airing in his shiny new brown Co-Ro-Lite stroller, he'll be a proud young man.

Low-pressure molded in one piece from a rope-fiber plastic impregnated with Durez resin, the stroller has a modern design which creates a streamlined appearance with its smooth rounded lines. Hedstrom Union Co., the manufacturer, has combined the plastic body with a frame and handle of aluminum tubing which makes for a light, easy-to-handle unit that will please mothers to whom the maneuvering of a carriage through crowded streets and stores is usually a wearisome task.

Another practical feature is that the synthetic material, besides being clean looking, is easy to keep clean, being unaffected by moisture or other atmospheric conditions. And, for all its light weight, the stroller is sturdily constructed to stand up under the wear and tear which may be expected from daily use and has heavy rubber tires.

* Reg U. S. Patent Office



1—This quarter-size, transparent methyl metacrylate model of a gas turbine served first as an aid in construction, later as a trainer

TRANSPARENT models

Industry is making increased use of models for construction and test purposes

by A. H. JENNINGS*

IN THE minds of a great majority of people, models and modelmaking are related to spare time activity. To some it means toy trains, or small airplanes, or mantlepiece models of ships. While it is true that modelmaking is fast becoming one of the leading hobbies of this country, this work is also playing an increasing part in industry—making an ever greater use of plastic materials.

True modelmaking dates back about 200 years when models were made of new ships of the fleet so the king could pass on the construction before work got under way. The shipbuilding industry has used models to great advantage ever since. During the last war, for example, every part of a ship built for the Government was made in miniature before work on the actual part was undertaken. Not only shipbuilders but industry in general has many uses for models. They are employed in design, as visual aids, for tests and in sales work, to mention just a few of the applications.

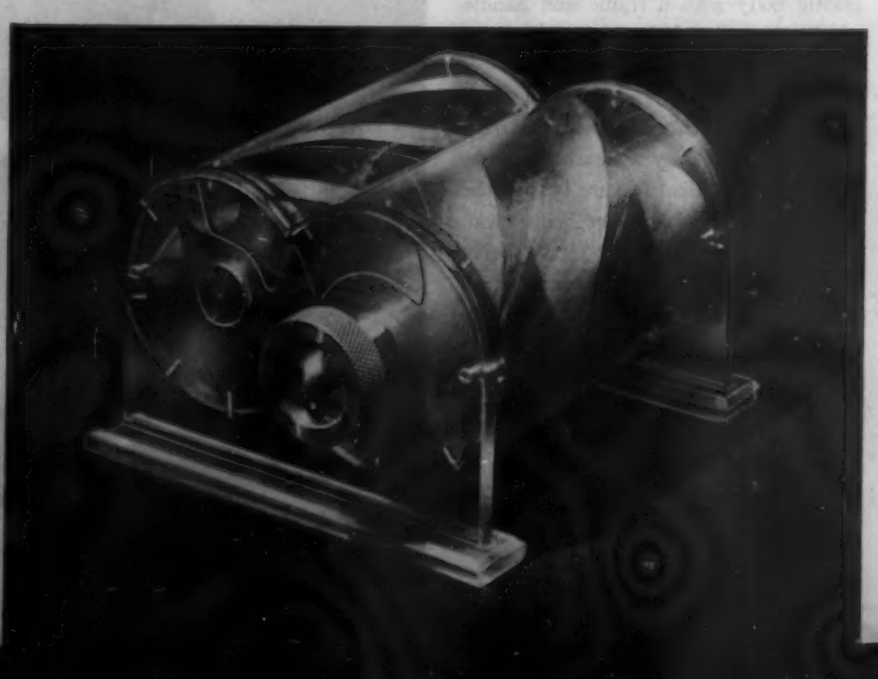
In the usual manufacturing process, the modelmaker's place is between the designing engineer and the detailing draftsman. The design engineer and perhaps a few draftsmen work with the modelmaker to create a three-dimensional model of the engineer's three-dimensional idea. In this way the engineer is able to see his idea "in the round" without the long process of trying to get a three-dimensional idea transferred to two dimensions. This model can be and usually is changed many times during its construction as new problems present themselves.

Making the model

Once the model satisfies the engineer it is taken to the various departments that will be concerned with its manufacture. As the personnel in these departments view the model, their particular problems are discussed and changes made that will aid their work. Then the model goes back to the draftsmen and they detail the product for actual manufacture using the model to aid them in incorporating the features already mentioned.

At the Elliott Company, models are used extensively for test, and in many cases these models are made of plastics. Testing of models in the aerodynamic engineering field has long been common practice. This was due, in part, to the lack of wind tunnels large enough to accommodate actual parts. In turbine development, however, the usual procedure is reversed and the airfoil

2—Transparent models are sales aids, explaining a unit's operation better than words. A use in point is a rotor for a compressor



* Model builder, Elliott Company.

enlarged for test purposes. This enables more accurate readings to be taken than would be possible with blades that are too small to include pressure taps.

Models can be made of acrylics, where the tolerances are not less than 0.002 in., in about one third the time required for metal. In one case (Figs. 3 and 4) the blade models were kept to a tolerance of 0.0005 inch. This was an exception, however, and the maintenance of such tolerances is not practical for general test purposes.

In this particular blade there are 20 pressure taps on the surface of the blade having a diameter of only 0.0135 inch. These holes intersect 0.35-in. holes that run to the end of the blade. Hypodermic tubing, 0.035 in. in diameter, was pressed into these holes and connected to manometers thus enabling pressure readings to be taken. Lucite was used on this job because of its degree of strength and transparency.

Another interesting use of transparent plastics was in model blower impellers used in the testing of blowers and in the scrolls for these blowers. Most of these latter models were made of cellulose acetate. While not as stable or as strong as acrylics, this plastic is very easily worked. The resulting speed of fabrication makes it ideal for this work.

A considerable amount of work is also being done along the lines of mechanical stress analysis using accurately fashioned plastic models. When these transparent parts are subjected to test and observed under polarized light, the nature of the plastic makes the lines of stress plainly visible. Deflection tests are also made using very accurate plastic models. In these tests plastic

ALL PHOTOS, COURTESY ELLIOTT CO.

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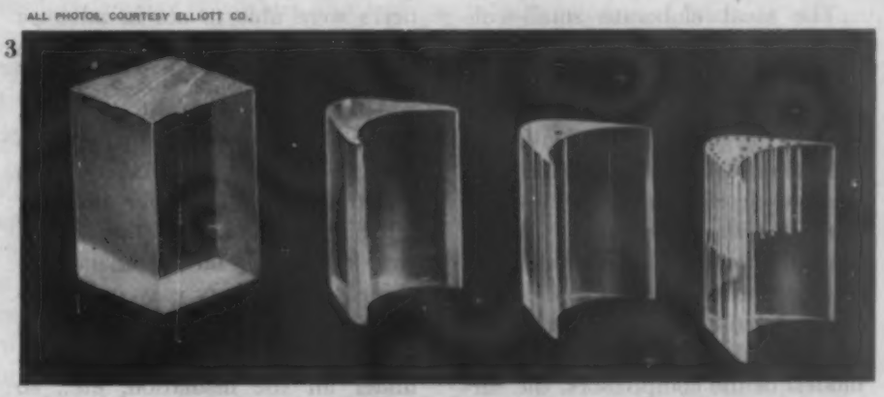

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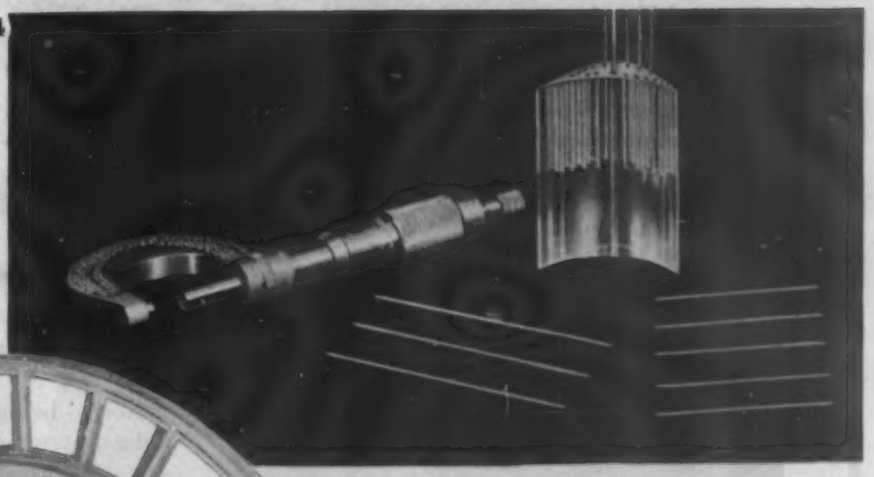

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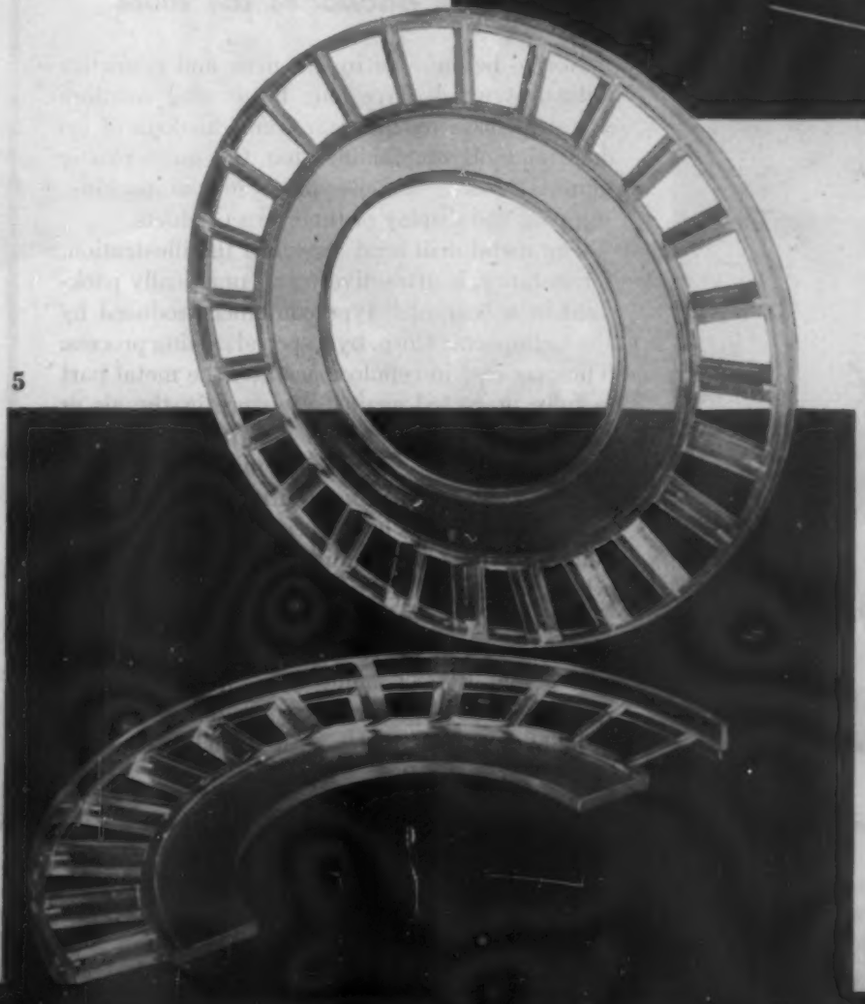


3 and 4—The exactness that can be achieved in methyl methacrylate models is evidenced in the turbine blades shown at top in various stages of production. Held to a tolerance of ±0.0005 in., a blade contains 20 pressure taps into which is pressed hypodermic tubing which is connected to a manometer for pressure readings

5—In studying stresses, a transparent model is often used, which, when observed under polarized light, clearly shows the parts that are receiving strain. Deflection tests can also be made with plastic models

was used because it worked faster than metal, more accurately than wood. Further, by making up test bars of the same material as the model, the modulus of deflection was definitely computed. This type of model is shown in Fig. 5.

A gas turbine plant

The most elaborate small-scale unit thus far constructed by the Elliott Company model department is the quarter-size model of the company's gas turbine plant (Fig. 1). It was constructed one unit at a time, each element being used in somewhat the same manner as outlined in the preceding paragraphs. Cellulose acetate sheet was chosen to represent stainless steel sheet metal work in this model. The models of the compressors, the turbine casings and like elements were largely constructed of wood since size, shape and appearance were the main considerations. The models (of the various units) proved invaluable to the sheet metal workers in building the actual machine. They not only had their detail drawings but, by reference to the model, could see exactly how each part would look when made up.

As the construction of the actual machine began to catch up with the model units, the intermediate parts were modeled and the quarter-scale plant assembled. Thus the engineers were able to see in advance just how each part would fit into the final picture.

After the actual plant was built, the model was prettied up, given a new coat of paint and further details added in preparation for the new job before it—to show things that were not visible on the actual machine. It is a very easy matter to trace the cycle on the model, and a glance will tell you what is hidden under all the insulation, etc., so necessary for an operating plant.

Sales aids

In the field of advertising and sales, models have a place all to themselves. A well made model, even of the most humble of objects, becomes at once a thing of interest. There is just enough of the little boy in all men to make them want to stop and look.

With a well made model, designed and built for sales purposes, all questions of design, construction, appearance and installation procedure can be answered by actual observation. This enables the salesman to concentrate on the technical data that makes his product superior. The use of transparent plastics in the construction is obvious.

Figure 2 shows a model of the rotor set-up used in the Lysholm-type Elliott compressor. This model was constructed for the purpose of showing the way walnut wood rotors mesh on this type compressor.

There is little doubt that models played an important role in the development of the machines necessary for victory. As industry becomes increasingly aware of the real purpose and value of models, their use will help bring about the speedier development of the articles for fuller enjoyment of the peace.

Acetate packages for tools

Not to be outdone by the drug and cosmetics industries which have long been using cellulose acetate packaging for their wares, makers of industrial tools are finding that the same plastic material has a definite place in the packing, shipping and display of their own products.

The metal drill head shown in the illustration, for instance, is attractively and practically packaged in a "capsule" type container produced by the Celluplastic Corp. by a special casting process. Thus encased in cellulose acetate, the metal part is fully protected against moisture in the air or on the hands of persons touching it. At the same time it is clearly visible and may be examined closely without removing from the container.

Similar packages have been designed for a wide range of products, including a small sewing kit in which the thimble forms a snap-on cover, a sanitary teething rattle and a lubricant whose contents are dispensed by fingertip pressure on the resilient plastic material. Toughness and light weight are qualities which make the containers especially valuable for some of these other products.

Designing around established plastic parts

When this desk tray was redesigned for improved performance, it was the metal base that was changed

SCRAP it and start fresh. This is the most familiar approach to the reworking of a piece of equipment that doesn't function as expected or that fails to appeal to the buying public. Or the article in question is stripped to its base and new parts and component pieces built up on this old foundation.

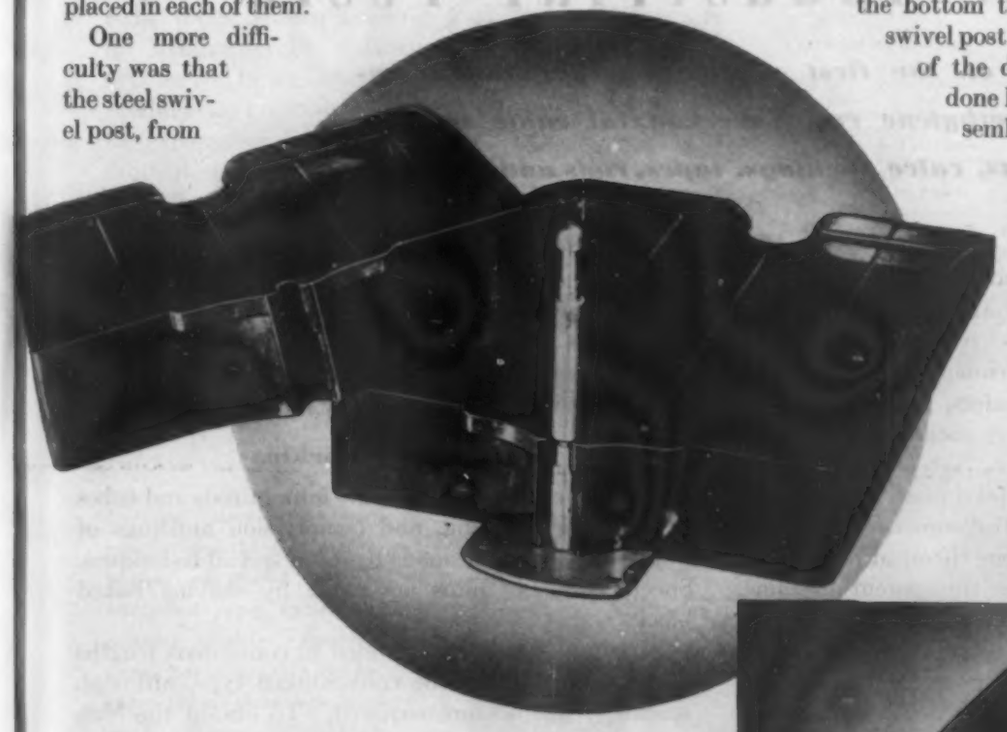
A designer just doesn't scrap the base of a unit while keeping all the rest of the parts—except that this is just what happened when this desk tray was rebuilt for better performance and sales appeal.

About 12 years ago, a set of rotary desk trays, made of medium impact phenolic material, was introduced to the public . . . and enjoyed rather poor sales volume. The trouble was that three trays, positioned one above the other, were just one too many. This was particularly true in view of the fact that the top trays could not be raised or lowered to allow for more correspondence to be placed in each of them.

One more difficulty was that the steel swivel post, from which the trays were suspended, was made to clamp onto the edge of a desk top. This meant that the unit could not be used on a desk which had no edge. And when it could be used the tray set was very apt to scar the finish of the furniture.

Such was the situation when, quite recently, the Art Steel Sales Corp. acquired the rights to the product. Work on the design of the tray set showed that the plastic parts needed no redesigning but that the metal post had to be completely revamped. As reconstructed, the metal supporting post allows the top tray to be placed in high or low position or to be removed for carrying. As can be seen in the photographs, the redesigned correspondence tray set has only two trays as compared with the three on the original model.

The clamp by which the early sets were held to the desk, has gone the way of all poor design. Instead, the bottom tray and the base of the metal swivel post rest firmly but gently on the top of the desk. Molding of the trays is done by Accurate Molding Corp.; assembly by Art Steel Sales Corp.



Left—The redesigned metal post for this desk tray has a rubber-footed base which, with the bottom tray, sits flat on the desk. The upper tray may be raised, lowered or removed with great ease

Right—Medium impact phenolic material is used in the molding of the two trays that are used for this new desk set. These trays are exactly like the parts used in the original tray assembly—the metal post having been redesigned to give the unit flexibility

1

2

1—Here two plastic rods are being lifted from a boiling bath of hot sulfuric acid. One is charred and deteriorated. The other—a rod of new tetrafluoroethylene resin—is not affected at all. 2—This rod, cylinder, thick sheet and film show four of the forms in which the new resin is now available

A new industrial resin

Some of the first applications for this tetrafluoroethylene resin are coaxial cable spacers, gaskets, valve packings, tapes, rods and cylinders

FOR industrial uses where heat endurance, unusual resistance to solvents and corrosive agents and good high-frequency insulation are required, Teflon, a new resin of E. I. du Pont de Nemours & Co., Inc., is expected to find a place. Cylinders, gaskets, coaxial cable, spacers and coverings, valve packings, tapes and rods are among the applications that have thus far been made from the material in pilot plant lots.

The resin is a polymer of tetrafluoroethylene, produced by polymerizing the gaseous chemical to yield a solid granular polymer which is transparent in thin sections, but in thicker pieces is waxy in appearance and white or gray in color and wax-like. No colored resins have been developed, but various inorganic fillers have been added successfully. As Table I shows, the outstanding properties of this plastic are its toughness over a wide range of temperatures, its electrical properties over a wide range of frequencies, its extreme chemical inertness and its heat resistance.

The resin has no true melting point but undergoes a solid phase at 620° F. with a sharp drop in strength. It decomposes slowly to yield the gaseous monomer plus a few other gaseous fluorine derivatives at around 750° F., and gives off small amounts of fluorine-containing gases above 420° F. Since the toxicology of these gases is not fully understood, good ventilation must be provided for extrusion and other operations in which these temperatures may be attained.

Methods of working

Teflon can be extruded in the form of rods and tubes or as a wire coating, and compression moldings of simple articles can be made by using special techniques. Sheets and thin films are made by shaving baked blocks and cylinders.

Rods and tubes are extruded in continuous lengths by screw stuffers of the conventional type, although special techniques are required. To obtain the high temperatures required for extruding, it is necessary to use electric heating pads regulated by controllers. Extrusion rates vary, but all of them are measured in terms of feet per hour, which is slow when compared to those of other thermoplastics. Wire is coated by using a crosshead die on a screw stuffer, with careful control of rates and of temperatures. Again the rate is slow when it is put to comparison with the more

conventional wire-coating operations that are usually employed for this purpose.

Chemical and electrical properties

Tests indicate that this plastic withstands the attack of all materials except molten alkali metals. It can be boiled in aqua regia, hydrofluoric acid or fuming nitric acid with no change in weight or in properties. It also resists the attack of organic materials and strong alkalies. Since it can be used over the temperature range of 100° to 480° F. immediate uses for it as a gasket and packing material and as tubing for chemical process work are suggested. Thus far, no cement has been found for the material, since nothing sticks to its surface with any mechanical strength.

Arc resistance, heat resistance and low electrical losses over a frequency range of 60 cycles to 3000 megacycles, combined with high heat resistance, suggest the use of this new plastic as a dielectric in coaxial cable for color television and radar.

Since molding techniques for this plastic are only in a developmental stage, complicated shapes must be produced by machining the standard shapes that are now available. Standard wood working or metal working tools, punch presses, flaring tools and standard pipe-threaders can be used if kept sharp.

The limited amount of Teflon presently available in rods, tubes, sheets, beading, gaskets and in tapes is for evaluation by customers. Moldings of special articles will be undertaken if it is felt that a satisfactory product can be produced. No powder will be available for experimental work of any kind until techniques of fabrication are more fully developed and detailed information can be furnished to molders.

Table I.—Typical Properties of "Teflon"[a]

Property	*Test result*	*Test method*
Specific gravity	2.1–2.3	D 792–44T
Tensile strength at 77° F., p.s.i.	2000–4500	D 412-41T[b]
Elongation 77° F., percent	300–400	Die C[b]
Flexural strength 77° F., p.s.i.	2000	D 650-42T[c]
Stiffness 77° F. (0.125 in. thick), p.s.i.	60,000	D 747-43T
Impact strength, Izod, −70, 77, 170° F., ft.-lb./in.	2.0, 4.0, 6.0	D 256-41T
Hardness, D. Durometer	55	....
Compressive strength at 0.1 percent deformation, p.s.i.	1700	D 695-42T
Yield temperature, ° F.	>320	Arl. M-8
Heat distortion temperature, low load, ° F.	266	D 648(b)-44T
Specific heat, cal./g./° C.	0.25	....[d]
Coefficient of expansion per ° F. (77–140)	5.5×10^{-5}	D 696–42T
Thermal conductivity (0.18 in. thick) B.t.u./hr./ft.²/° F./in.	1.7	Arl. P-32[e]
Brittleness temperature, ° F.	< −100	D 746–43T
Dielectric strength, short time (0.080 in. thick), volt/mil	480	D 149-40T[f]
Volume resistivity, ohm-cm.	10^{16}	D 257-38
Dielectric constant 60, 10^3, 10^6, 10^9 cycles	2.0	D 150-40T
Power factor 60, 10^3, 10^6, 10^9 cycles	<0.0002	D 150-40T
Water absorption, percent	.....	D 570-42[g]
Moisture permeability, g./meter²/-24 hr.	0.00–0.5	D 697-42T
Outdoor weathering	No detectable change in 1 yr.	

a Data given represent standard commercial grades of material and standard methods of testing except where otherwise noted.
b Tensile strength in oriented film may be as high as 15,000 p.s.i.
c Specimens do not break.
d Method of mixtures.
e Cenco-Fitch apparatus.
f 1000–2000 volt/mil in 5- to 12-mil thickness.
g Not wet by water.

ALL PHOTOS, COURTESY E. I. DU PONT DE NEMOURS & CO., INC.

3—This new industrial plastic should find application as flared tubing, threaded pipe, cylinders, coaxial cable spacers, tape, gaskets, plug cocks, valve-stem packings and rods, many of which are shown in the accompanying illustration

Plastics Stock Molds*

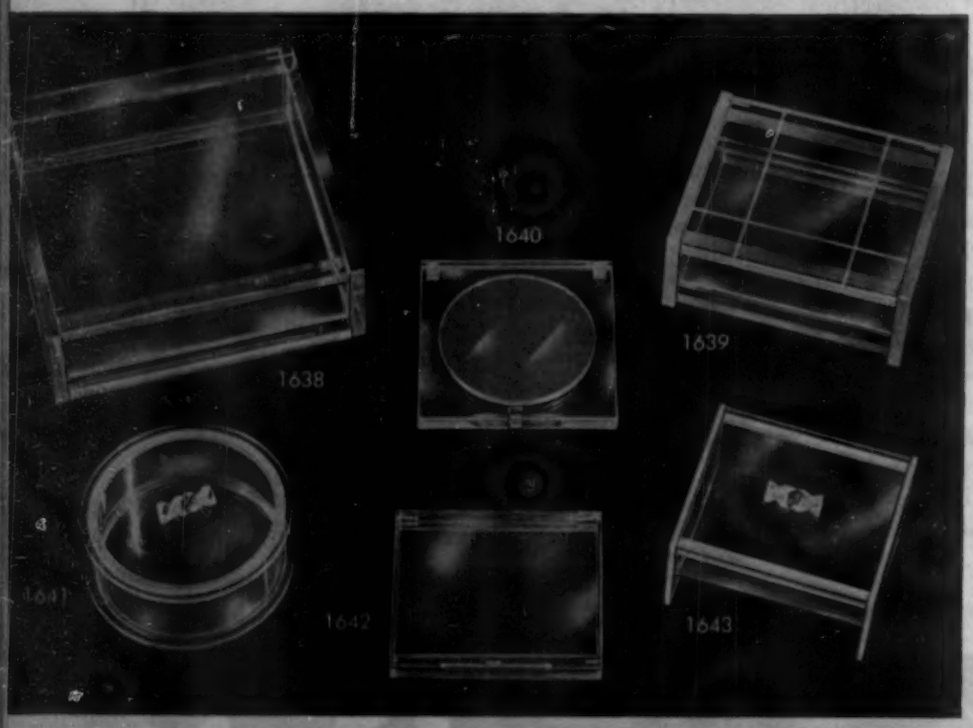
SHEET ONE HUNDRED THIRTY-EIGHT

Crystal clear methyl methacrylate rods and sheets are used to fabricate these sparkling, simply designed decorative accessories. Additional information, manufacturers' names and addresses, may be obtained from the Stock Mold Div., MODERN PLASTICS, 122 E. 42nd St., New York 17, N. Y. Please state sheet and item number

1638. Candy or jewelry box with hinged cover. 6 in. square by 2 in. deep

1639. Candy or jewelry box with engraved hinged cover, 4¾ in. long by 4 in. wide by 2 in. deep

1640. Square compact hinged at corners.



1641. Round powder box with removable cover. 3¼ in. in diameter by 1½ in. deep

1642. Flat cigarette case. Holds half pack. 3¾ in. square

1643. Cigarette or jewel box with deep curved well. Overall dimensions 3⅞ in. long by 3¼ in. wide by 1¾ in. deep

1644. Double-faced rectangular hand mirror. 6 in. long by 5¼ in. wide

1645. Round double-faced hand mirror one side magnifying. 6½ in. in diameter

1646. Rectangular double-faced hand mirror with looped handle. 6 in. long by 5¼ in. wide

1647. Oval double-faced mirror, one side magnifying. 6½ in. long by 5 in. wide

1648. Round double-faced hand mirror. 5½ in. in diameter

1649. Round double-faced hand mirror. One side magnifying. 5½ in. in diameter

1650. Round double-faced hand mirror. One side magnifying. 3½ in. in diameter

1651. Round double-faced hand mirror. 3½ in. in diameter

* Reg. U. S. Patent Office.

Items 1–1582, which have appeared previously, are correlated in the Plastics Stock Mold Catalog, available for $5.00

Molders and fabricators are invited to submit samples of stock products to appear on these pages as space permits

Plastics Engineering®

F. B. STANLEY, Engineering Editor

From raw material to fountain pen

Both roll laminations and hand layup operations are used to achieve the variety of patterns we see in today's cellulose nitrate fountain pens

by WALTER G. TUCKER†

TODAY an estimated 90 percent of all fountain pens are made from cellulose nitrate, the first plastic used in the manufacture of these pens. Considering the way sales have increased by leaps and bounds, the continued and increasing popularity of this material has presented the manufacturers of cellulose nitrate with the problem of keeping pace with the demand. Another problem is keeping ahead of competitors.

One way of meeting the competition has been to better the quality of their product, both as to physical properties and accuracy of dimension. More important, perhaps, the producers of cellulose nitrate have worked to achieve better styling and eye appeal for their material. While a solid color fountain pen barrel and cap are admittedly equal in performance to caps and barrels produced from mottled or patterned material, a variety of designs had to be developed to meet the requirements of both pen manufacturers and the consumer public.

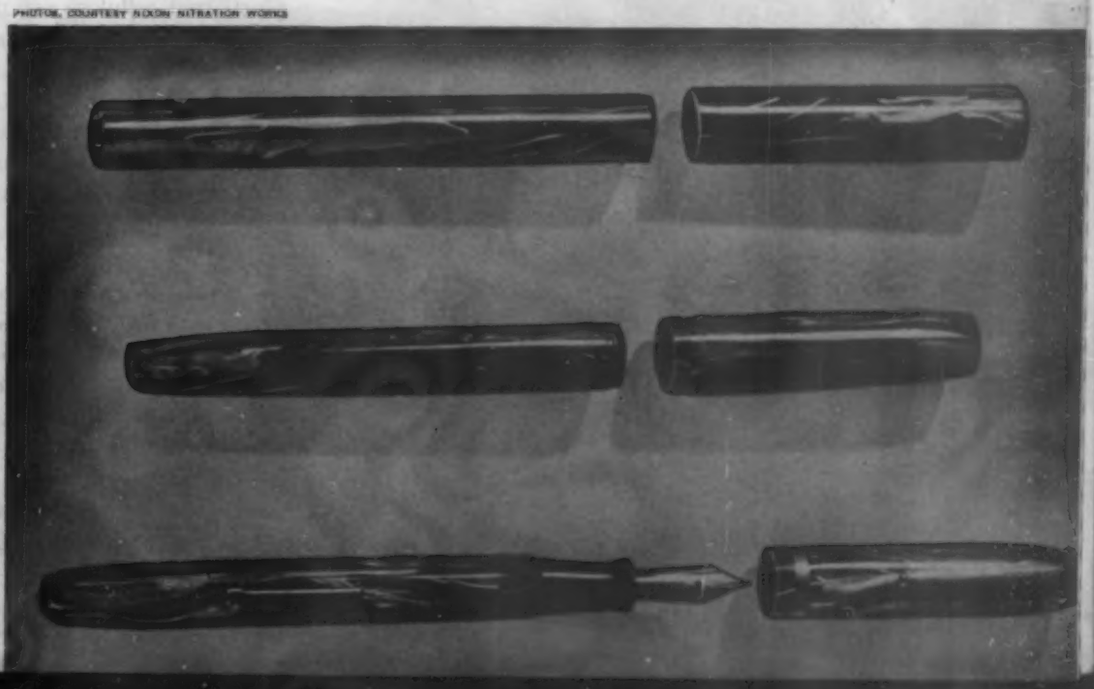
The many configurations and geometric patterns available in cellulose nitrate today are made possible by a series of roll laminations or by hand layup operations. Panelled designs, simulated wood grains and grained ivories are examples of patterns produced by one or the other of these operations. Of particular interest is the method by which a panelled pearl design, consisting of a series of pearled panels 1/8 in. wide separated by plain colored or transparent strips, is produced. Alternate pearl and transparent panelling assembly is necessary in pens utilizing visible ink supply principle.

Incorporation of pearl essence

The first step in the preparation of such a pattern is the incorporation of the pearl essence in the pyroxylin material. Pearl essence is a substance deposited on herring scales which, after removal, is refined and suspended in a suitable carrier such as cellulose nitrate lacquer. Essence itself comes in tiny flat crystals, longest being less than 0.003 inch. (*Please turn to next page*)

* Reg. U. S. Patent Office.
† Nixon Nitration Works.

PHOTOS, COURTESY NIXON NITRATION WORKS



The three stages in the development of a fountain pen show it when its two parts have been cut from cellulose nitrate tubing, after the parts have been formed and threaded, and after assembly of all parts have been completed

2 A batch of material, weighing, in most instances, 250 lb., is made up of the proper proportions of pearl essence suspended in its lacquer, camphor as a plasticizer, tinting dyes, cellulose nitrate flake, and alcohol as a solvent. These materials are placed in a large mixer whose action insures the complete intermingling of the components. Following the mixing, any foreign matter which might contaminate the batch is filtered out.

The equipment used in this operation is very similar to a large hydraulic extruding machine; and the filter is made of a disk of muslin backed up on one side by several screens, each having a different mesh. These screens are backed, in turn, by a solid back plate perforated by 1/4 in. holes spaced about 1/2 in. apart. After the material is placed in the cylinder of the filter, a hydraulic plunger forces it slowly through the filtering muslin and screens and it emerges from the filter orifice in the form of spaghetti. At this point, the material is still a soft and pliable mass due to the solvent remaining in the mix.

Approximately 60 to 70 lb. of the soft filtered plastic are measured out into a round tubular container
3 and weighted down. After a period of time, pressure from this top weight causes the material to lose its spaghetti-like appearance and become a homogeneous mass. That this is possible is due to the solvent remaining in the material which keeps it in a soft or pasty-like form.

Extruding the cellulose nitrate

The charge of plastic, now known as a jelly roll, is removed from the tubular form and taken to the extrusion room. Measuring 48 in. in length and 8 in. in diameter, and weighing 120 lb., the roll is of the proper size and shape to fit into the chamber of a hydraulic extruder. This extruder, known as a stuffing machine, is quite similar to the hydraulic filter previously described except that the orifice end of the machine is equipped with a die which causes the material to take the form of a tube. Heating elements, positioned around the chamber of the machine and also attached
4 to the tubing die, raise the temperature of the still plasticized cellulose nitrate so that it can be properly extruded from the machine.

The extruded plastic tube is generally about 6 in. in diameter and has a relatively thin wall section. Just as it issues from the die, it is slit at the top so that it can be flattened from its tubular form into a sheet. As the split tube flattens out it travels along an inclined table.

2—Alcohol and camphor have already been placed in this mixer into which cellulose nitrate flake is being loaded. The action of the mixer insures the complete intermingling of the components that go to make up the pens. 3—To remove impurities, the cellulose nitrate paste is filtered through the muslin screen shown at the right. 4—The plastic material emerges from the filter in a spaghetti-like form; it is still soft and very pliable

It is this extrusion operation that is the first secret of the successful production of a high luster pearl effect. The action of forcing the mixture through the narrow orifice of the extruder causes the tiny pearl essence particles to align themselves in the direction of extrusion, thereby presenting the maximum amount of luster to the surface of the sheet. If the pearl essence were not oriented in this manner, a relatively lusterless sheet would be produced.

Slice and slice again

In the next step in the forming of fountain pen material, the sheet is cut into strips or into large chips, depending on whether a ribbon or mottled pearl effect is desired. These strips or chips are then placed flat in a cake-press form measuring 23 by 56 in. and built up to a depth of 5 inches. The charge is subjected to heat and pressure until the strips or chips become a solid homogeneous mass, called a cake, after which the material is chilled until it becomes hard. The necessary pressure is in the neighborhood of 1 to $1^1/_2$ tons per sq. in. of molding surface.

Sheets of material $^1/_8$ in. thick are sheared from the top of the cake and stripped to approximately 5-in. widths. Again the material is laid up in the cake press, but this time the strips are laid on edge rather than flat. The caking cycle is repeated until the strips have once again become a solid mass. This time, however, the luster of the pearl essence is oriented toward the side of the cake rather than toward the top.

Once more the cake is sheared into sheets—but this time the thickness of the sheet is determined by the width of the plastic pearl panel desired in the finished pen. The sheets at this phase of manufacture have very little surface luster inasmuch as the pearl essence was deliberately oriented to the side of the cake in the last pressing operation. Once again, sheets are cut into 5-in. widths and again placed on edge in the cake press form. This final layup orients the luster to the top surface of the cake.

At the time of this layup, or loading into the cake press, the ultimate design is prepared. This may entail inserting various colored plastic strips between the pearl strips, or transparent cellulose nitrate strips if the design is for a pen utilizing the visible ink supply principle. Once again, the caking cycle is repeated. This operation is followed by a slicing of the cake into sheets approximately 0.050 in. thick.

Since these sheets must be seasoned to remove all of the remaining solvent, they are placed on racks located in rooms with a temperature held at approximately 110° F. The seasoning operation tends to make the sheets curl up somewhat. This difficulty is overcome by placing the sheets between high luster metal plates and subjecting them to a relatively high pressure in a hydraulic press. The sheets are then cut into strips $1^1/_2$ in. wide by 50 in. long. In this form they are ready for the final tube forming operation.

Two tube forming methods

There are two methods of forming the tube. One results in a straight buttweld tube; the other produces a spiralweld tube. In both cases, the strips are first placed in hot water to soften them, then pulled through a forming die which causes the strip to take the shape of a tube.

(Please turn to next page)

5—In the next step, about 60 lb. of the plastic is formed into what is known as a jelly roll. Here this roll is being placed in the hydraulic extrusion machine. 6—In the pearl orientation operation, the cellulose nitrate emerges from the extruder in the form of a tube. The breaker at the top of the machine splits this tube and allows it to fall onto a moving belt on which it is carried away in sheet form

5

6

7 8

7—After the extruded pearl sheet has been sliced into chips by the guillotine-type cutter (shown in background), the chips are laid flat but at random in the cake press form so that the luster will be oriented toward the top of the form and thus give the desired mottled effect. 8—The slab formed in the cake pressing operation is then sliced into sheets preparatory to the making of another layup

Buttweld type—For the buttweld type, a steel mandrel is placed inside a die having a diameter equal to the desired outside diameter of the cellulose nitrate tube. One end of the nitrate strip is hooked on to the front end of the mandrel which, in turn, is attached to a moving chain. As the chain begins to pull the mandrel through the die, the nitrate strip is drawn into the funnel-shaped mouth or entrance of the die which starts the forming of the strip so it will wrap around the mandrel, and thence into the final forming section of the die. Sudden chilling of the nitrate as it comes in contact with the cold die sets the material into a form of a tube with the edges of the joint pressed tightly together. This operation does not weld the joint.

Spiral type—If the spiral type tube is desired, the only change is the revolving of the mandrel as it pulls the material through the die.

Sealing the tube

After the tube has been formed it is placed in a tank of solvent to affect the sealing of the edges. The edges of the joint of the tube must be separated to permit the solvent to come in contact with them. In the case of the straight butt, this is done with a hooked knife blade that is run through the entire length of the joint. As for the spiral type, the operator gives the tube a slight twist in the opposite direction from the spiral, thus opening the joint enough for the solvent to enter. No additional pressure other than that furnished by set of the tube itself is needed for a perfect welding job.

The tubes are then hung in seasoning rooms for approximately 3 weeks to insure the removal of all traces of the solvent which was absorbed by the material during the welding operation.

Although glued together, the cellulose nitrate tubes are still in too crude a condition to be useful in the manufacture of fountain pen barrels and caps. The dimensional requirements of the pen manufacturers are very rigid and, for this reason, the tubes must now be brought to accurate size.

Bringing the tube to size

The first operation is directed toward the achieving of an accurate inside diameter. The tubes are placed in hot water which causes them to become soft and pliable. A steel mandrel, ground to a size corresponding to that of the required inside diameter, is slipped inside of the tube—or rather, the softened tube is drawn over the mandrel. Tube and mandrel are then placed in a chilling bath of cold water. After a short period of time, the nitrate again hardens and the mandrel is withdrawn.

The tube, now having an accurate I.D., is passed through a centerless grinder which produces an accurate dimension on the outside diameter. With this operation, the cellulose nitrate manufacturer can call his job completed, and the tubes are shipped to the fountain pen manufacturer. There, by standard machining methods, the tubes are cut to length, threaded and otherwise machined.

It is also necessary to close up one end of the tube to produce the barrel and to close one end of the cap. This operation necessitates the insertion and welding of shaped and formed ends.

There are two or three ways that this is done. Sometimes just a flat top is welded to the end of the tube. This method was generally used for the older types of pens. Newer methods make use of a shaped end which can be produced by molding or, in some cases, by a simple forming operation in which a disk of heated nitrate is forced into a die and then molded to the desired shape. Another method which probably produces the most satisfactory job makes use of a so-called swedging operation. In this case, the tube which has been cut to the required length, is softened, and the end is forced into a warm die and molded into a point; producing a cap or barrel of one-piece construction.

Wood grain and reptilian designs

As mentioned at the start of this article, the panelled pearl design is not the only kind of pattern that can be achieved using cellulose nitrate. Intricate reptilian designs have been produced by further manipulation of the same basic operations employed in the production of the pearl essence designs.

As for the wood grained effects, they are achieved through the use of a roll laminating process. Take, for an example, a rosewood design. Here black and cherry colors are prepared and milled on separate two-roll mills. When the stock reaches a rubber-like consistency, it is removed from the rolls in heavy blankets about 1 in. thick. The cherry and black are then placed one on top of the other and fed into one set of rolls. This acts to laminate the two colors together, and the process is repeated until there is approximately 16 plies per inch.

When viewed from the side, this lamination presents an alternate cherry and black grained effect, closely simulating natural rosewood. The stock is then cut into strips 5 in. wide and inserted lengthwise, on its edge, in the cake press form. After the cake pressing operation, sheets of the desired thickness are sliced from the top of the cake.

Tubes with wood grain effect can also be produced directly by the extruder. These have found extensive use as a beautifying and protecting cover for golf club shafts. The plastic tubes are stretched oversize in the material processing plant, slipped on the shaft of the club and shrunk to a tight fit by the action of placing the assembly in hot water. The plastic memory of the stretched tube accounts for the shrink fit.

Results justify expense

While the expense of producing cellulose nitrate pens by the process described in this article is greater than that involved in the processing of many competing materials, the beauty, configuration and strength of the finished product has been judged by numerous pen manufacturers to more than justify the increased cost.

Credits—Nixon C/N is the cellulose nitrate used in the plant described and pictured in this article.

9—In this final layup operation for making a fountain pen body, strips of variously colored materials are stacked in an order, which when viewed from above, will reveal the finished pattern effect. 10—Here a strip of the properly patterned material is being pulled into the tube forming die in the spiral wrapping operation. A straight buttweld-type tube can also be formed from this sheet using a different die

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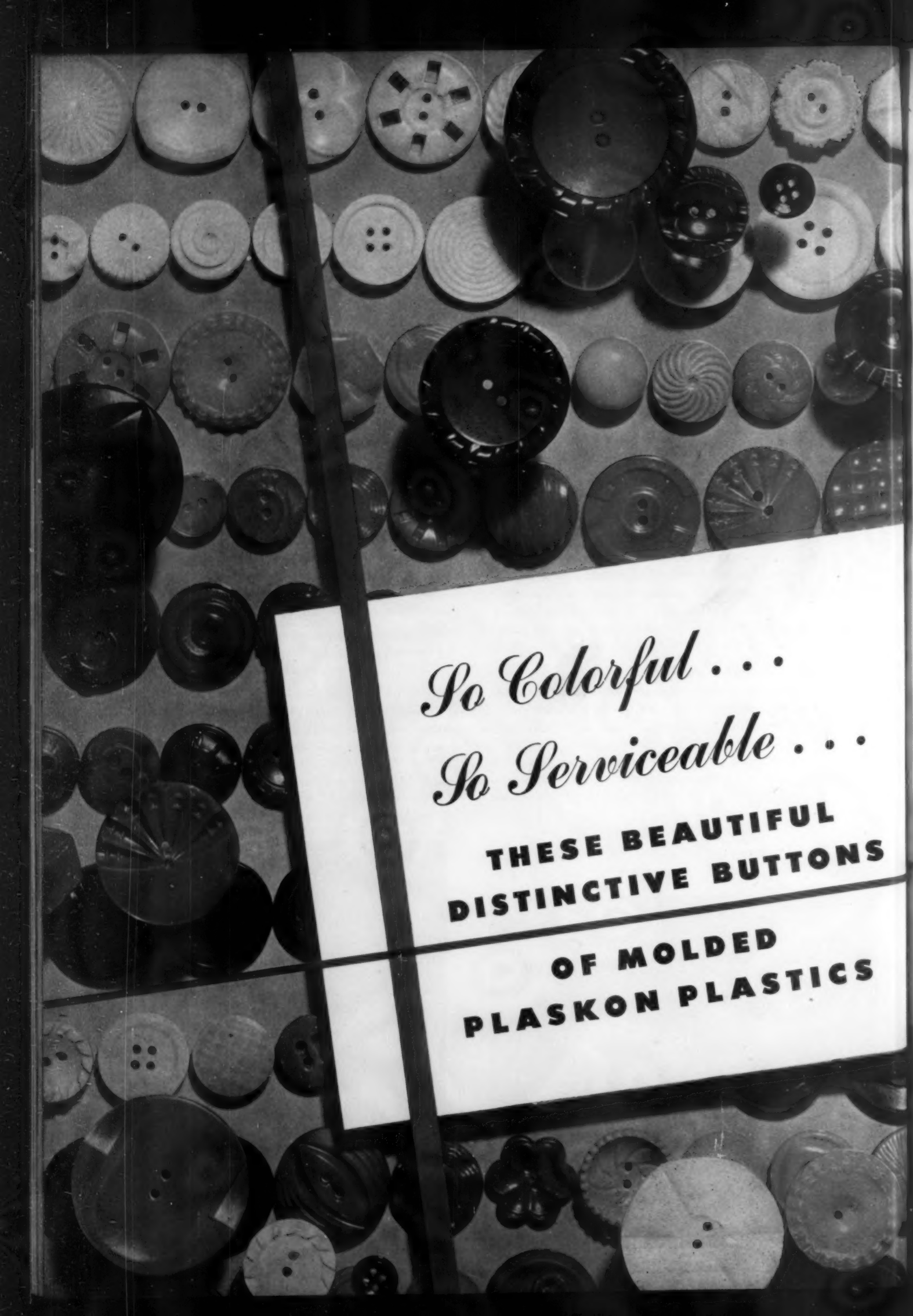
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YOU SEE them everywhere . . . on garments of every type ranging from expensive gowns to heavy-duty work clothes. Plaskon buttons are truly all-purpose, because of their many distinctive features.
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Buttons are only one of the many modern uses of Plaskon urea-formaldehyde and melamine-formaldehyde plastics. We shall be glad to help you adapt the many advantages of these versatile materials to your manufacturing and merchandising needs. Write for free illustrated book on Plaskon plastics.
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Data on low-pressure laminating resins*

THE following discussion is intended to amplify the data presented in the attached chart on low-pressure laminating resins and thus give added clarity to the material presented. The balance of the data (on a second chart) will be published in the July issue of MODERN PLASTICS magazine.

In general, the resins covered may be divided into three categories. Those in the first groups, consisting of the phenol-formaldehyde and melamine-formaldehyde resins, are basically the same as the conventional type of high-pressure laminating resins but have been modified to increase their flow properties and thus enable cure at pressures much below those normally used in high-pressure laminating. These resins are normally applied to the Fiberglas filler from solution and the laminates are cured at pressures up to 250 p.s.i.

The resins in the second category are normally liquid before cure (at elevated temperatures if not at room temperature) and they are usually applied directly to the glass fiber cloth without the use of a solvent. Laminates made with this type of resin are normally cured at pressures up to 15 p.s.i. (contact pressure).

The third type of resin used for low-pressure laminating is the conventional thermoplastic material which is applied to glass fabric sheets from solution or fluxed onto the filler by a radiant heating process. Laminates are prepared from treated sheets by the application of heat and of pressures running in the neighborhood of 100 p.s.i.

Inasmuch as these three types of resins are basically different both in properties and methods of handling, discretion should be used in comparing data presented for a resin in one group with that given for resins of the other group. The manufacturer's code number and a general description of the type of resin is given under this heading.

The total price per pound of resin as shipped is given. In those cases where the resin comes in more than one part, this price is calculated on the basis of the formulation recommended by the manufacturer and the prices of the individual components. Where a resin is sold in solution, the price quoted is per pound of solution of the solids content specified. All prices are for carload lots of the material of the largest quantity price quoted by the manufacturer. These prices are the latest figures obtained from the manufacturer and in most cases are subject to change.

Physical characteristics of uncured resin

Percent solids—Figures in this category represent the percent resin or resin-forming material in the liquid as shipped. In most cases, this figure also represents the percent resin in the liquid as applied to the glass fiber cloth. However, in the case of the phenol- and melamine-formaldehyde resins, the viscosity of the treating solution is often adjusted by addition of further solvent. Du Pont BCM and the thermoplastic resins are frequently applied from solution so that the percent resin in the case of these materials is also different from the value as shipped.

Solvents—Solvents for all of the resins covered are given although in the case of many of these resins, no solvent is used in the treating operations.

Storage conditions and life—Wherever possible, data on the life of the resin as shipped and the pot life of the resin are given. The pot life represents the length of time a resin may be stored after it has been prepared for use in treating. In all cases, the storage life of the resins is increased markedly by storing at reduced temperature, and wherever care is not taken to avoid exposure of the resin, the figures given in the chart may be reduced appreciably. Many of these resins are catalyzed by the ultraviolet in direct sunlight and this is indicated on the chart by noting that the resins should be stored in the dark.

Modifications—In some cases the base resin may be modified by the addition of some other resin, plasticizer or extender. Wherever the data on this type of procedure are available, they have been incorporated in the chart under the above heading. In the case of some resins, the modifiers specified are always used. In some cases, the modifiers are incorporated directly in the resin as sold. Wherever the use of a modifier is optional, its effect on the properties of the laminate is indicated on the chart.

Treater operations

Resin content—This figure represents the resin content to which the manufacturer feels Fiberglas sheets should be treated in order to produce a good structural laminate. The values given are either an approximate value or a range within which the proper value should be. For many applications, resin contents outside this range might be used in order to obtain certain desired properties in the laminate. The grade of glass fabric employed will also have an effect on the resin content to be used. In all cases, the values given on the chart are intended for broad comparative purposes and as a guide to the laminator in determining by experiment what resin content is required in the particular application in which he is interested.

Impregnation—Preparation of the various resins for treatment usually consists of dissolving the catalyst in the resin. In some cases this requires heating of the resin and this information is given in the chart. A good deal of care must be taken in agitating the resin to aid solution of the catalyst. Excessive agitation may beat air into the resin and the air may inhibit those resins

* Prepared by York Research Corp., Plastics Div., for Owens-Corning Fiberglas Corp.

DESCRIPTIVE

PREPARED BY YO

Manufacturer	Resin		Price	Physical characteristics of uncured resin							Treater operation					
								Storage						Impregnation		
	Company number	Identity	Price/lb./ carload f.o.b.	Solids	Viscosity, centipoises	pH	Solvents	Conditions	Life	Modifications	Resin content	Catalysts	Inhibitors	Apparatus	Preparation of resin	
			¢	%							%					
AMERICAN CYANAMID CO. PLASTICS DIV.	Laminac 4000	Unsaturated polyester resin	0.55	100	Normally solid (a paste) at room temperature	Neutral	Acetone, alcohols, ammonia.	No catalyst in dark: 32° F. 77° F. 104° F.	1 yr. 3 mo. 3 to 4 wk.	Copolymerized with monostyrene.	38 to 45	2.0% by weight benzoyl peroxide	Air, Lead, Copper, Bronze, Rubber	Dip tank Squeeze rolls Knife coating	Melt resin in water bath at 120 to 130° F. Stir in catalyst.	
	Laminac 4116	Unsaturated polyester resin	0.45	100	25° C. 300 to 380	Neutral	Acetone, alcohols, ammonia.	No catalyst in dark: 32° F. 77° F. 104° F.	1 yr. 3 mo. 3 to 4 wk.	Copolymerized with monostyrene	38 to 45	2.0% by weight of Lupersco ATP-1. (extended benzoyl peroxide)	Lead, Copper, Bronze, Rubber	Dip tank Squeeze rolls Brush coating Spreading	Add catalyst to cold resin. Agitate without introduction of air.	
	Laminac 4122	Unsaturated polyester resin	0.45	100	25° C. 150 to 225	Neutral	Acetone, alcohols, ammonia.	No catalyst in dark: 77° F. 104° F. With catalyst in dark: 77° F.	> 6 mo. > 30 days > 5 days	Copolymerized with monostyrene	38 to 45	2.0% by weight of Lupersco ATP-1. (extended benzoyl peroxide)	Air, Copper, Sulfur, Rubber, Antioxidants, Bronze	Dip tank Squeeze rolls Brush coating Spreading	Add catalyst, Dissolve by agitation for 10-15 min. without introduction of air. Stir in cold.	
	Laminac 4125	Unsaturated polyester resin	0.45	100	25° C. 370 to 440	Neutral	Acetone, alcohols, ammonia.	No catalyst in dark: 32° F. 77° F. 104° F.	1 yr. 3 mo. 3 to 4 wk.	Copolymerized with monostyrene	38 to 45	2.0% by weight of Lupersco ATP-1. (extended benzoyl peroxide)	Lead, Copper, Bronze, Rubber	Dip tank Squeeze rolls Brush coating Spreading	Add catalyst. Agitate without introduction of air into cold resin.	
	Laminac 4201	Unsaturated polyester resin	0.45	100	25° C. 170,000 90° C. 300	Neutral	Acetone, alcohols, ammonia.	No catalyst in dark: 32° F. 77° F. 104° F.	1 yr. 3 mo. 3 to 4 wk.	Copolymerized with an allyl ester	38 to 45	2.0% by weight of Lupersco ATP-1. (extended benzoyl peroxide)	Lead, Copper, Bronze, Rubber	Dip tank Squeeze rolls Calendered Knife coating	Melt resin in water bath at 120° F. Stir in catalyst without introducing air.	
	Melmac 403	Melamine-formaldehyde resin	0.52	60-65		9-9.5	Water, water and alcohol mixtures	Dry resin powder as shipped Mixed resin solution ready to apply	1 yr. 4 to 8 hr.	Powder B acts as modifier for melamine resin acting as a flux to increase flow of resin.	40 to 50	Avoid cast iron		Dipping Brushing Roller-coating Glue spreader	Mix 9 parts of powder A to 1 part B. Add to required amount of water with agitation until dissolved.	
DUREZ PLASTICS AND CHEMICALS CO.	12109 12120 12668	Phenolic resin	0.175	70 as shipped	25° C. 300-500 can be adjusted	Neutral	Ethyl alcohol	Room temperature Below 50° F. (as shipped)	1 mo. 3 mo.		30 to 50			Conventional dip tank	Adjust to desired viscosity and solids content with alcohol.	
E. I. DU PONT DE NEMOUR & CO., INC. PLASTICS DEPT.	BCM	Addition type of polymer	1.25	100	12.3	Neutral	Ketones, alcohols, esters, glycols, aromatic hydrocarbons.	No catalyst in dark: 40° F. 80° F.	Indefinitely > 3 mo.	Polyvinyl butyral or polybutyl methacrylate increases viscosity of monomer. Styrene improves mechanical properties of laminates Polymethyl methacrylate (*See Note 1*) Tri-cresyl phosphate Rosin esters	30 to 43	Peroxides 0.1-0.5 by weight ultra-violet light For straight BCM 0.2% lauroyl peroxide	Uncured phenolic resins	Dip tank Squeeze rolls Spreading Spray Brush	Add peroxide catalyst	
		Cellulose acetate	0.32 for 55—59% acetic acid substitution	30% for treating Shipped as 100%	Depends on resin formulation. Varied at will	Neutral	90:10 mixture of acetone: alcohol		Stable indefinitely	Any plasticizer used with resin in molding powder can	60 to			Dip tank Knife coating Brush Spray Spreading Hot melt	Dissolve resin.	

IPTIVE DATA ON LOW PRESSURE LAMINATING RESIN

REPARED BY YORK RESEARCH CORP., PLASTICS DIVISION FOR OWENS-CORNING FIBERGLAS CORP.

Treater operations									Curing operations								Heat distortion point		
Impregnation		Volatile content	Flow content	Drying			Storage		Mold release agent	Equipment			Curing cycle						
	Preparation of resin			Apparatus	Optimum oven temp.	Time	Temp.	Life		Presses	Molds	Ovens	Optimum pressure	Optimum temp.	Thickness	Time	Cast resin temp.	Laminate temp.	
		%	%		°F.		°F.						p.s.i.	°F.	In.		°F.	°F.	
tank e rolls oating	Melt resin in water bath at 120 to 130° F. Stir in catalyst.						77.. 104..	.. 3 wk. .. 1 day in cellophane	Glassine paper, cellophane, polyvinyl alcohol, cellulose acetate, silicone stopcock grease. 10% sol'n of PVA in H_2O with aerosol.	Conventional type	Sheet metal, wood, concrete, plaster.	Heated air forced draft Autoclave	Contact 15 to 30	216 at center of laminate	Any thickness	30 min.	212	617	
tank e rolls coating ding	Add catalyst to cold resin. Agitate without introduction of air.	May lose 10% by weight of styrene.					77.. 104..	2-3 days 2-3 hr. in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate, silicone stopcock grease. 10% sol'n of PVA in H_2O with aerosol.	Conventional type	All conventional types	All conventional types	Contact 15 to 30	216 at center of laminate	Any thickness	20 min.	212	545	
tank e rolls coating ding	Add catalyst. Dissolve by agitation for 10-15 min. without introduction of air. Stir in cold.	May lose styrene					77.. 104..	1 wk. <1 day in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate, silicone stopcock grease. 10% sol'n of PVA in H_2O with aerosol.	Conventional type	Sheet metal, wood, concrete, plaster.	Heated air forced draft Autoclave	Contact	212.. 216.. at center of laminate	0.045-0.050 Any thickness	..30 min. ..20 min.	230	545	0.
tank e rolls coating ding	Add catalyst. Agitate without introduction of air into cold resin.	May lose styrene 10% of weight.					77.. 104..	1 wk. <1 day in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate, silicone stopcock grease. 10% sol'n of PVA in H_2O with aerosol.	Conventional type	All conventional types	All conventional types	Contact 15 to 30	216 at center of laminate	Any thickness	20 min.	212	545	
tank e rolls dered oating	Melt resin in water bath at 120° F. Stir in catalyst without introducing air.						77.. 104..	3 wk. 1 day in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate, silicone stopcock grease. 10% sol'n of PVA in H_2O with aerosol.	Conventional type	All conventional types	All conventional types	Contact	216 at center of laminate	Any thickness	20 min.	212	545	
ping shing -coating prender	Mix 9 parts of powder A to 1 part B. Add to required amount of water with agitation until dissolved.	10 to 20 Depends on pressure		Any conventional type	70-80.. 250..	..3-4 hr. ..3-4 min.	75 or lower	6 wk. to 2 mo.	Carnauba wax, stearates.	Any standard equipment	Any standard equipment wood or wax mold. Plaster should be sealed.	Any standard equipment	40	230 to 250	Less than ¼ ½...	..30 min. ..45 min.			
tional tank	Adjust to desired viscosity and solids content with alcohol.	7-9	10-20 (estimate)	Continuous tunnel dryer	Enter at 200. Raise to 250-275	Adjust to give required volatile content	Below 75	Up to 6 mo.	Cellophane, silicone D200	Platen or hat press	Any standard equipment		60-100	340 Heat supplied on one side	0.05 to 0.10	10-15 min.	374		
tank no rolls nding ray rush	Add peroxide catalyst	0.21		Forced circulation oven	105-110	20 min.	55-65 no light Room with light.	.. 3 mo. .. 4 days	Cellophane, cellulose acetate, polyvinyl alcohol.	Platen Circulating hot water heated 95° C.	Any material of construction	Forced circulation oven	10-15	203 to 212	With PMMA ⅛... ½...	..10 min. ..20 min.	High load 201 Low load 450	40% PMMA High load 170 Low load > 350	0.
tank coating rush ray ding mold	Dissolve resin.	Under ½		Oven	176	12 hr. Adjust by any means until		Stable indefinitely	Laminates free themselves from cold surface.	Standard equipment. Platen	Standard equipment	Standard equip.	100				129.2 Hard		Set Dry .207 Medi Dry .024

RESINS

P.

Heat distortion point		Electrical properties of cast resin											Arc resistance	End application	General notes
		Freq. 60 cycles			Freq. 10^3 cycles			Freq. 10^6 cycles			Dielectric strength				
Cast resin temp.	Laminate temp.	Power factor	Dielectric constant	Loss factor	Power factor	Dielectric constant	Loss factor	Power factor	Dielectric constant	Loss factor	Short time	Step-by-step			
°F.	°F.										v/mil.	v/mil.			
212	617													Decorative applications, semi-structural applications, luggage.	Shrinkage during cure 8%. Can use special Calco pigments to color resin. Resin has a slight yellow cast. Cool treated Fiberglas in air before winding on roll.
212	545													Decorative applications, semi-structural applications, luggage.	Shrinkage during cure 8%. Can use special Calco pigments to color resin. Resin has a slight yellow cast.
230	545	0.011	4.2	0.053				0.031	3.5	0.120	⅛ in. sample 820		90-126 material burns on failure	Decorative applications, semi-structural applications, luggage.	Shrinkage during cure 8%. Can use special Calco pigments to color resin. Resin has a slight yellow cast.
212	545													Decorative applications, semi-structural applications, luggage.	Shrinkage during cure 8%. Can use special Calco pigments to color resin. Resin has a slight yellow cast.
212	545													Decorative applications, semi-structural applications, luggage.	Shrinkage during cure 8%. Can use special Calco pigments to color resin. Resin has a slight yellow cast. Blended with 4116 or 4125 for intermediate properties.
														Heating ducts, high heat resistance, good dimensional stability.	Resin cures to a yellow to orange color. Darkens with age. Can be pigmented but limited color possibilities. Must provide venting in molds so laminate can breathe.
374								0.03	0.055	0.00165	450-600				Shrinkage estimated as 0.5-1.0%. 12108 is olive drab color. 12120 is natural color. 12668 is black color. Resin comes in alcohol solution.
High load 201 Low load 450	40% PMMA High load 170 Low load > 350	0.02	5.7	0.114	0.017	5.5	0.003	0.04	5.0	0.2	⅛ in. sample 370	⅛ in. sample 250		Aviation structures, automotive structures, decorative applications.	At present, this resin is being produced only on an experimental scale. It is available, therefore, only in small trial quantities. For 100% BCM 13.3% shrinkage. Can reduce shrinkage with PMMA Note 1: Typical formulation is 40 parts PMMA to 60 parts BCM The PMMA is dissolved in a mutual solvent as acetone.
129.2 Hard		Soft Dry .207 Wet .63 Medium Dry .024 Wet .21	Soft Dry 6.8 Wet 15.1 Medium Dry 5.2 Wet 8.4					Soft Dry .043 Wet .032 Medium Dry .040 Wet .059	Soft Dry 6.4 Wet 7.5 Medium Dry 4.4 Wet 6.0			Soft Dry 300 Wet 250 Medium Dry 300 Wet 300		Luggage, automotive applications, industrial housings, switch boxes,	No shrinkage of resin. Flat sheets are usually made and then postformed at 310-325° F.

resin.			Oven	176	means		indefinitely	cold surface.		equipment	equip.	

HERCULES POWDER CO.		Cellulose acetate	0.32 for 38—39% acetic acid substitution 0.33 for Acid outside this range	20% for treating Shipped as 100% solids	Depends on resin formulation. Varied at will	Neutral	90:10 mixture of acetone: alcohol		Stable indefinitely	Any plasticizer used with resin in molding powder can be used for lamination.	60 to 70			Dip tank Knife coating Brush Spray Spreading Hot melt Radiant heat coating for 100% resin.	Dissolve resin.	
		Ethyl cellulose	0.52 For 5000 lb. or more	20% For treating Shipped as 100% solids	Depends On resin formulation. Varied at will	Neutral	Ethyl acetate		Stable indefinitely	Any plasticizer used with resin in molding powder can be used for lamination.	60 to 70			Dip tank Knife coating Brush Spray Spreading Hot melt Radiant heat coating for 100% resin.	Dissolve resin	
MARCO CHEMICALS INC.	MR-1A	Allyl type	0.55	100	May be varied between 30 or 40 to 100,000 at 25° C.	Neutral	Ketones, esters, alcohols soluble in chlorinated hydro-carbons	Uncatalyzed rm. temp....	.. 1 yr.		30 to 50		Sulfur bearing compounds	Dip Brush Spray	Add catalyst, stir	
								Catalyst rm. temp....	.. 1 wk.							
	MR-17-A	Unsaturated polyester	0.55	100	120,000 at 40° C. Can adjust with modifier	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydro-carbons	Uncatalyzed 70° F.....	.. 3 mo.	MR-17-A solvent (monomer) Dissolve catalyst then mix with resin.	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds.	Dip tank Spray Brush Knife coating	Heat monomer to 40° C by hot water bath. Add catalyst to resin with stirring.	
								Refrigerated.	> 3 mo.							
								Catalyst rm. temp...	.. 1 wk.							
	MR-17-B	Unsaturated polyester	0.45	100	120,000 at 40°C. Can adjust with modifier. Adjustable to water consistency	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydro-carbons	Uncatalyzed 70° F.....	.. 3 mo.	MR-17-B solvent (monomer) Dissolve catalyst, then mix with resin prior to use.	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds.	Dip tank Spray Brush Knife coating	Heat monomer to 40° C by hot water bath. Add catalyst to resin with stirring.	
								Refrigerated.	> 3 mo.							
								Catalyst rm. temp....	.. 8 hr.							
	MR-17-C	Unsaturated polyester	0.45	100	120,000 at 40° C. Can adjust with modifier. Adjustable to water consistency	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydro-carbons	No catalyst 70° F.....	.. 3 mo.	MR-17-C solvent (monomer) Dissolve catalyst, then mix with resin prior to use.	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds.	Dip tank Spray Brush Knife coating	Dissolve 1.2 gm. benzoyl perox. in 22 gm. of MR-17-C solvent. Add to 100 gm. of resin.	
								With catalyst rm. temp.....	..1 wk.							
	MR-17-D	Unsaturated polyester	0.45	100	120,000 at 40° C. Can adjust with modifier.	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydro-carbons	No catalyst 70° F.....	.. 3 mo.	MR-17-D solvent (monomer) Dissolve catalyst, then mix with resin prior to use.	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds.	Dip tank Spray Brush Knife coating	Dissolve 1.2 gm. benzoyl perox. in 22 gm. of MR-17-D solvent Add to 100 gm. of resin.	
								Refrigerated.	> 3 mo.							
								Catalyst rm. temp....	.. 1 wk.							
MONSANTO CHEMICAL CO., PLASTICS DIV.	Resinox 45815	Phenolic	0.30		350 to 450 at 25° C.	Between 7-8	Denatured alcohol, acetone, water	Before mix no catalyst, cool dry, air tight	1-3 mon. for liquid. Powder indefinitely		50 to 55			Dip tank	17 parts of dry powder to 100 parts of liquid. Mechanical agitation.	
								Minimum pot life....	.. 3 days							

Dip tank Knife coating Brush Spray Spreading Hot melt Radiant heat coating for 100% resin.	Dissolve resin.	Under ½		Oven	176	12 hr. Adjust by any means until volatile is reached		Stable indefinitely	Laminates free themselves from cold surface. Can use stearates.	Standard equipment. Platen type usual.	Standard equipment	Standard equip.	100				12 Ha for lat
Dip tank Knife coating Brush Spray Spreading Hot melt Radiant heat coating for 100% resin.	Dissolve resin	Under ½		Oven	176	12 hr. Adjust by any means until volatile is reached		Stable indefinitely	Laminates free themselves from cold surface. Can use stearates.	Standard equipment. Platen type usual	Standard equipment	Standard equip.	100				10 Ha for lat
Dip Brush Spray	Add catalyst, stir						Rm.	2 wk.	Cellophane, P.V.A.	Any standard equipment	Any standard equipment	Any standard equipment	Contact	Start at 158 Raise to 248 slowly	⅛.... ¼....	2-4 hr. 4-8 hr.	
Dip tank Spray Brush Knife coating	Heat monomer to 40° C by hot water bath. Add catalyst to resin with stirring.						40° F.	2 wk.	Cellophane, Marco separating compounds		Wood, plaster, aluminum, steel.	Circulating air; Infrared	Contact	158.. 320..	....⅛.... ....⅛....	5-10 min. 5-10 min.	27
Dip tank Spray Brush Knife coating	Heat monomer to 40° C by hot water bath. Add catalyst to resin with stirring.						40° F.	16 hr.	Cellophane, Marco separating compounds.		Wood, plaster, aluminum, steel. Bag mold is practical.	Circulating air. Infrared	Contact				27
Dip tank Spray Brush Knife coating	Dissolve 1.2 gm. benzoyl perox. in 22 gm. of MR-17-C solvent. Add to 100 gm. of resin.						40° F.	2 wk.	Cellophane, Marco separating compounds		Wood, plaster, aluminum, steel. Bag mold is practical.	Circulating hot air. Infrared.	Contact	278.6	0.03..	..10 min.	27
Dip tank Spray Brush Knife coating	Dissolve 1.2 gm. benzoyl perox. in 22 gm. of MR-17-D solvent. Add to 100 gm. of resin.						40° F.	2 wk.	Cellophane, Marco separating compounds		Wood, plaster, aluminum, steel. Bag mold is practical.	Circulating air. Infrared.	Contact	278.6	0.03..	..10 min.	27
Dip tank	17 parts of dry powder to 100 parts of liquid. Mechanical agitation.	2.5 to 3.5		Standard oven. Dry to volatile given	185	1 to 1½ hr.	Rm.	2-3 days	Waxes and stearates	Any standard type	Any standard type	Any standard type	40 Range from 15 to 100	230 to 240	¼....	30-60 min.	Ove 21

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		120.2 Hard formulation		Soft Dry .307 Wet .63 Medium Dry .024 Wet .21 Hard Dry .025 Wet .141	Soft Dry 6.8 Wet 15.1 Medium Dry 5.2 Wet 8.4 Hard Dry 5.0 Wet 7.9					Soft Dry .043 Wet .052 Medium Dry .049 Wet .059 Hard Dry .031 Wet .043	Soft Dry 6.4 Wet 7.5 Medium Dry 4.4 Wet 6.6 Hard Dry 4.2 Wet 6.4			Soft Dry 300 Wet 250 Medium Dry 300 Wet 300 Hard Dry 350 Wet 350 *See Note 1*		Luggage, automotive applications, industrial housings, switch boxes, carpet sweepers.	No shrinkage of resin. Flat sheets are usually made and then postformed at 310-320° F. **Note 1.** Specimen approximately 0.10 in. thick.
		109.4 Hard formulation		Soft Dry .013 Wet .029 Medium Dry .0084 Wet .015 Hard Dry .000 Wet .02	Soft Dry 4.2 Wet 5.0 Medium Dry 2.9 Wet 4.1 Hard Dry 3.2 Wet 4.6					Soft Dry .037 Wet .042 Medium Dry .012 Wet .017 Hard Dry .012 Wet .02	Soft Dry 4.2 Wet 4.5 Medium Dry 3.3 Wet 4.1 Hard Dry 3.2 Wet 4.6			Soft Dry 500 Wet 450 Medium Dry 550 Wet 500 Hard Dry 550 Wet 500 *See Note 1*		Luggage, automotive applications, industrial housings, switch boxes, carpet sweepers.	No shrinkage of resin. Flat sheets are usually made and then postformed at 310-320° F. Ethyl cellulose should be heat stabilized using menthyl phenol. Marketed as stabilizer X by Hercules. **Note 1** Specimen approximately 0.10 in. thick.
⅛	2-4 hr.		320	0.005	3.52	0.0176	0.0045	3.46	0.0156	0.0156	3.36	0.051				Applications requiring high temp. stability, marine building materials, floor tile, automotive panels, flexible and rigid wall coverings.	Colored objects can be produced.
¼	4-8 hr.																
⅛	5-10 min.	273.6	345.6	0.011	3.70	0.0406	0.0008	3.60	0.0352	.0308	3.36	0.07				Shingling material, electrical parts, luggage, aircraft, marine building material, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 8-10% during cure. Clear and colorless. Higher temp. stability and greater chemical resistance in laminate than other resins of this series.
⅛	5-10 min.																
		273.6	345.6	0.011	3.70	0.0406	0.0008	3.60	0.0352	0.308	3.36	0.07				Shingling material, electrical parts, luggage, aircraft, marine building material, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 8-10% during cure. Clear and colorless. General purpose resin. Quicker curing than other resins of this series.
0.03	10 min.	273.6	345.6	0.011	3.70	0.0406	0.0008	3.60	0.0352	0.308	3.36	0.07				Shingling material, electrical parts, luggage, aircraft, marine building material, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 8-10% during cure. Clear and colorless. General purpose resin. Most extensively used resin of this series.
0.03	10 min.	273.6	345.6	0.011	3.70	0.0406	0.0008	3.60	0.0352	0.308	3.30	0.07				Shingling material, electrical parts, luggage, aircraft, marine building material, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 8-10% during cure. Opaque white. Self extinguishing by A. S. T. M. D-635-44.
¼	30-60 min.	Over 216					0.70	19.25	13.5	0.0536	6.56	0.0847	101		5-10 sec.	Building materials, furniture, cabinets, luggage, aircraft contours.	Shrinkage during cure, 8-10%. Color of resin is reddish brown. Transparent resin supplied in two parts, liquid and powder.

sensitive to air inhibition, or it may result in the presence of air bubbles in the finished laminate with any of the higher viscosity resins. In all cases where a two- or three-part resin is involved, the recommended proportions for mixing are given under this heading.

Almost all conventional types of sheet coating equipment are used in treating Fiberglas with these various resins. For laminators using fairly large quantities of material and with resins of low or medium viscosity, the most common type of treater is the dip tank, usually with squeeze roll attachment. For the high viscosity resins, a knife coater is the most readily applicable type of equipment. Any of the resins can also be applied by brushing, roller coating or a glue spreader. Some of the resins can be sprayed on but this method is not applicable with high viscosity resins and is not recommended for resins which are sensitive to air inhibition.

Volatile content—The volatile content of a treated sheet of glass fiber fabric is only significant for those resins which are applied from solution. In the case of many of the other resins, the treated, uncured glass fabric sheets will have very high volatile content but the volatile material is completely reactive and, after curing, it is still present as part of the resin in the laminate. Where solvent is used, the volatile content is measured after the treated glass fiber cloth has been dried and it is a measure of the amount of flow that can be expected in the curing operations. Where given, the volatile content is the percentage weight lost from a 3-in. diameter sample on heating for 10 min. at 300° F.

Flow content—In some cases the flow content or greenness of treated, uncured Fiberglas sheets is measured as a further control point. This figure represents the amount of resin squeezed out of a sample of treated sheet at some specified temperature and pressure. Because of their very great flow before curing, this test does not have any significance for most of the resins of the contact laminating type and, therefore, no data are given in the chart for flow content of glass fabric treated with contact resins.

Drying—This operation applies again only to those resins which are applied to glass fiber cloth from solution. The type of drying equipment used almost universally for this step in the treating operation is a heated-air forced-circulation drying tunnel which is attached to the end of the treating apparatus (normally a dip tank). However, infrared drying has some application and where room temperature is adequate, festoon dryers are sometimes used. The chart gives data on optimum drying temperature and the approximate drying time required to attain the volatile content specified for that material.

Storage—This value represents the life of treated, uncured glass fabric sheets when stored at the conditions specified.

Curing operations

Mold release agents—Many of the resins covered in the attached chart will adhere to the mold or platen used in curing so that it will be impossible to remove the finished laminate. If one of the materials specified under this heading is used as a liner sheet or coating on the mold, removal of the finished product from the mold will be facilitated.

Equipment—A number of processes have been developed for making laminates at low pressures and each requires its own specialized equipment. Almost all of the resins covered in the attached chart can be handled with any of the different types of equipment and where this is not true, the type of equipment which is applicable has been specified.

Molds may be constructed from any material which can be formed or machined to the desired shape. All the less expensive metals and alloys as well as wood, plaster, glass, concrete and similar materials are all used for this purpose. In some cases, one or more of the above mentioned materials has an inhibitive effect on a particular type resin and cannot be used satisfactorily in a mold for that reason.

Several of the processes use a flexible rubber bag or blanket for one of the mold surfaces. With this type of set-up the laminate is placed in an air-heated oven or autoclave for curing, depending upon the pressure required. Another variation involves the application of vacuum under the rubber blanket using a heated cored mold or an oven as the source of heat.

In many cases, a conventional heated platen press is used at low pressures for producing flat sheets. A hat press is also used frequently for the molding of small objects that are characterized by having comparatively simple contours.

Curing cycle—The time specified for the curing cycle is usually the time required after a thermocouple placed in the center of the laminate reaches the specified temperature. This eliminates the variables of heat transfer through the molds and the laminate structure. For many of the resins, the thickness of the laminate that is under construction will have no effect at all on the required curing time provided that the time is measured as specified above.

Heat distortion point

This value is determined by the standard A.S.T.M. test under high load. This information is intended only as a guide to the high temperature properties of the resin. Preparing glass fiber cloth laminates with any of these resins increases the high temperature stability of the structure appreciably.

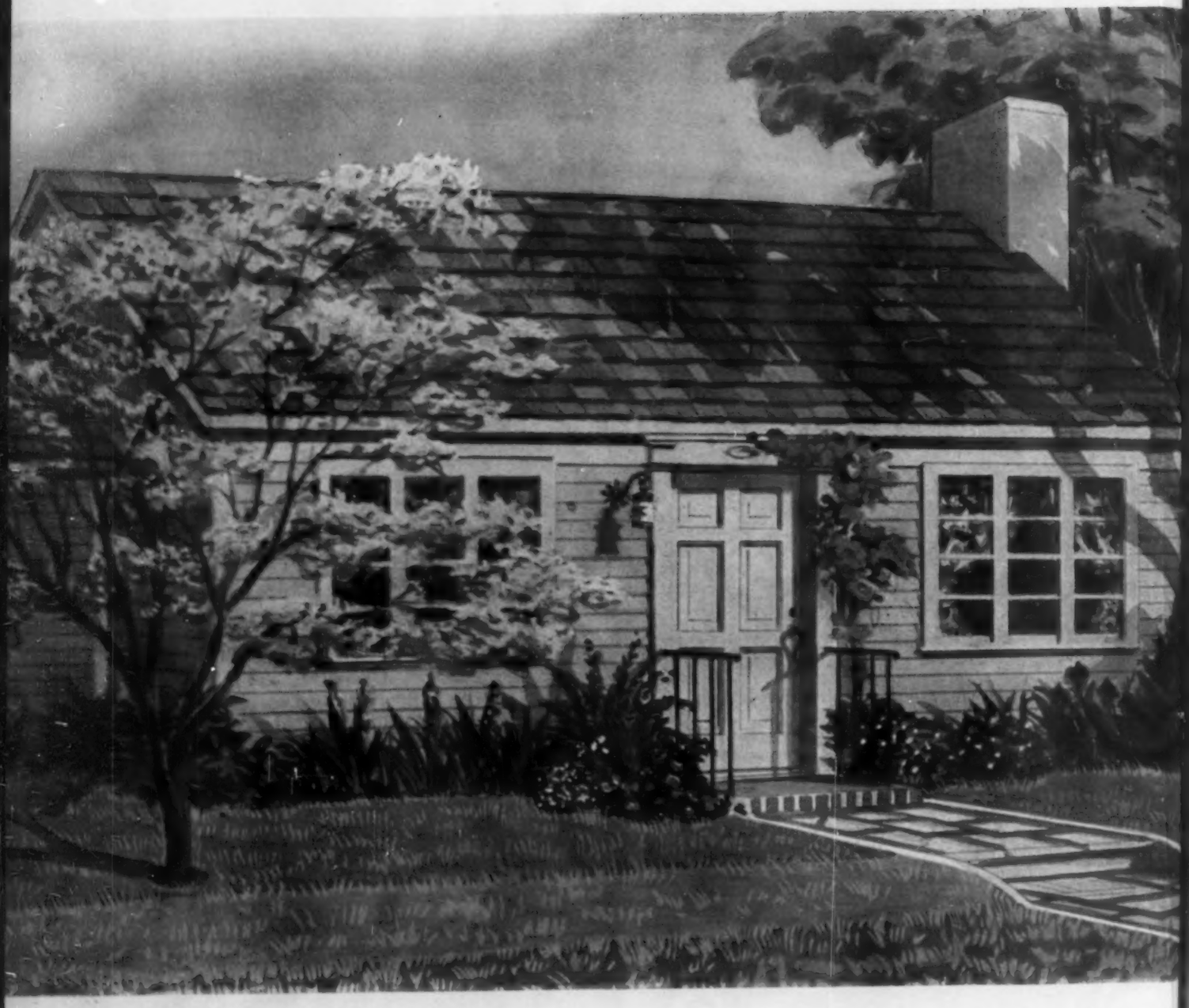
Electrical properties

The data presented under this heading are for resin castings and are based upon standard tests that have long been established.

End applications

The information presented represents for the most part, projected applications of the various resins used in conjunction with Fiberglas in low pressure laminates based on experience gained in the use of these materials for wartime applications.

Phenac Resin



Cyanamid Plastics

BEETLE* · MELMAC* · MELURAC* · LAMINAC* · URAC*

Adhesive

HELPS SOLVE A HOUSING PROBLEM

America's in a hurry for houses...for *wood* to build! Prefabricated plywood homes, shop-fabricated walls and floors, partitions and roofs, wooden units, are in demand.

Fast, sturdy construction methods have been made possible through the use of amazing resin adhesives. With PHENAC* resin adhesive 703, prefabricated components for houses can be put together in short order. This new glue forms a strong, durable, moisture-resistant bond for millwork and joint assemblies on prefabricated houses.

PHENAC resin adhesive 703 is a modified phenol resorcinol adhesive developed by Cyanamid to form a boil-resistant glue line. The strong, durable bond of phenolic and melamine adhesives can be achieved with PHENAC resin adhesive at temperatures not less than 70°F. Also, PHENAC resin is lower in cost than conventional resorcinol glues.

PHENAC resin 703 is one of Cyanamid's latest additions to its line of woodworking adhesives and industrial resins which are speeding up production of stronger, more durable wood products. MELMAC, MELURAC, URAC resins and adhesives insure economical, dependable production of hot and cold press plywood and wooden assemblies such as wooden boat hulls, truck bodies, laminated timber, or the bonding of laminates to wood.

We shall be glad to work with you in solving specialized gluing problems and in the use of Cyanamid resin adhesives for better wood products for today and tomorrow!

AMERICAN CYANAMID COMPANY
Plastics Division
32 Rockefeller Plaza, New York 20, N.Y.

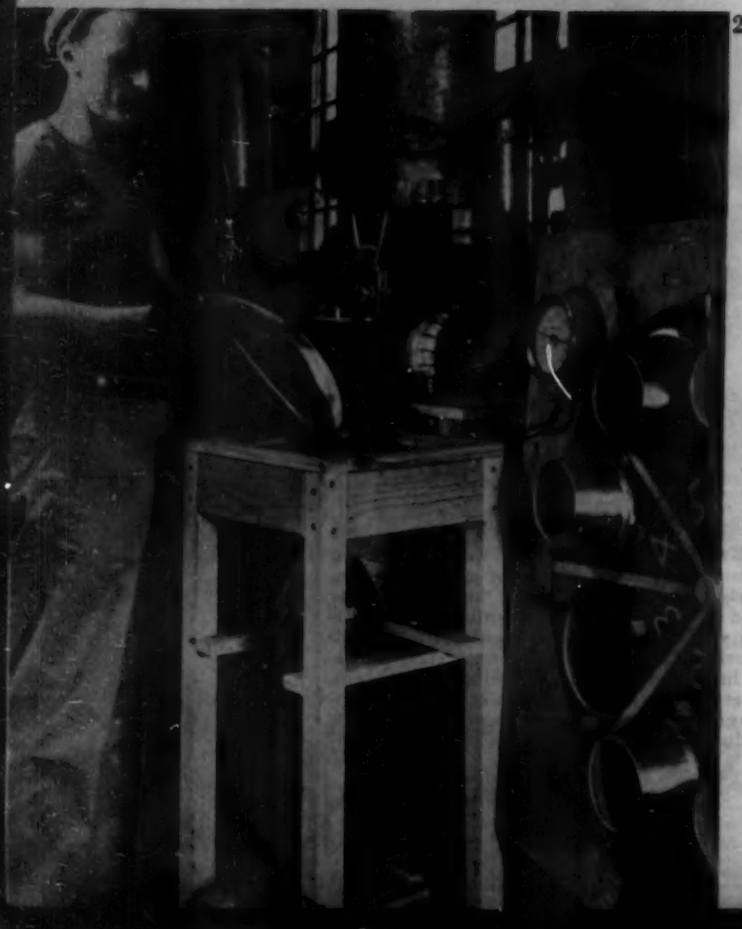
THE BEAUTIATOR, a new electric manicuring machine produced by the Abar Manufacturing Company of Cleveland, Ohio, is housed in a clean, sanitary, colorful BEETLE* plastic case. Attachments for the machine perform five manicuring operations, disc filing, cuticle rolling, cuticle whisking, nail buffing, and oil massaging. Tests indicate the Beautiator will give trouble-free performance for normal use for at least twenty years.

YOUR CUSTOMER'S DEMAND FOR COLOR in washing machine agitators, vacuum cleaner housings, food trays, tableware, refrigerator and stove parts, and many other commonly used items, can now be met with a shock-resistant thermosetting plastic, MELMAC plastic 3020. Available in many brilliant, permanent colors, MELMAC plastic 3020 also has the advantages of being lightweight, chemically inert, odorless, and tasteless. The washing machine agitator shown here is molded by Eclipse Moulded Products Company.

*Reg. U.S. Pat. Off.

Preheating without preforming

1



2

IN the molding of plastics, heat is required to convert the molding powders or granules to a semi-fluid condition so that the material will be able to fill the mold completely and uniformly. With thermosetting materials, both *heat* and *pressure* are necessary to cause the required chemical action to take place in optimum time to convert the plastic from the fusible to the infusible state. This is commonly known as setting-up or curing, and the temperatures that are needed vary from 250 to 350° F. depending upon type of material.

In considering the process of compression molding, not from the viewpoint of the tools and operations necessary to make a good part but rather with an eye to the transformation of the material, three variables must be taken into account—pressure, temperature and time. In their normal granular state, molding compounds are hard and stiff. No reasonable amount of pressure will cause them to flow as a plastic. However, as they are heated they soften to a point of minimum viscosity whereat they tend to flow readily under pressure. The chemical action of polymerization or cure then begins to accelerate so rapidly that the material becomes more and more rigid despite the previous softening action of the heat.

Preforming for preheating a problem

An appreciable amount of time is necessary to bring each charge of material placed in a hot mold up to this softening temperature. And if molding compound at room temperature is introduced into a hot mold, not only is there a considerable lapse of time before the material reaches its softening temperature, but the layers of the plastic through the cross section and parallel to the mold surface are heated successively by conduction. The reason is that plastics are relatively good heat insulators so that quite often the outer layer of material is beginning to cure before the inner layers are softened.

As long as cold plastics are introduced into the mold, parts can be made only if the mold temperature is reduced. This means long press cycles which are costly not only because of the time they consume but because of the extra service and maintenance work they entail. The thing then is to cut this molding cycle to the very minimum. And preheating of molding compound has been found a major factor that insures this speed up.

High frequency preheat has become nearly indispen-

1—An operator is weighing a charge of powdered thermosetting material to be preheated in the oven with rotating fixture (right). In order to preheat thermosetting material in powder form, it is necessary that it be continuously agitated to eliminate caking. 2—Close-up of the funnel arrangement used for loading the powder container

sable for the molding of very thick cross sections which would otherwise be either impossible or most uneconomical to produce in this manner. Preheating by heated oven or infrared lamp is adequate, however, for the processing of many parts. The economics of high-frequency preheating versus the other methods depends on the cost of the installation as compared with the value of the press time that is saved. But regardless of whether heated oven, infrared or high-frequency preheat is employed, it is nearly always necessary to preform the molding compounds before they are preheated.[1] In some cases, were it possible to eliminate the expense of preforming, a reasonable amount of the cost of molding a thermosetting part might well be saved—the extent of the saving being in direct proportion to weight of material required for the part.

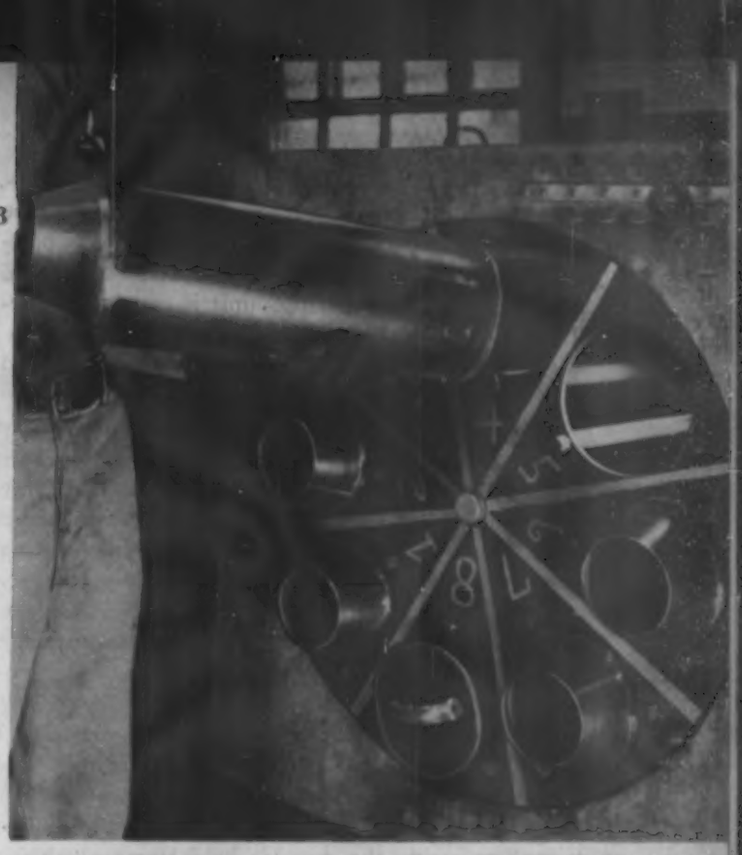
Take, as an example, a molded phenolic radio cabinet with a weight of approximately 1100 grams, or about 2½ pounds. It is well known that the molded radio cabinet market is highly competitive and the saving of even ½ cent per cabinet on a unit of this size will often mean the difference between the molder getting the order or losing it to a competitor. In the case of the housing shown in Fig. 5, the Mack Molding Company was able to save a reasonable part of its cost by eliminating the preforming of the material. But in doing so it was faced with problem of slower molding cycle and higher percentage of rejections.

A rotating heater for loose molding powder

The solution worked out by this molder for the preheating of his plastic molding materials lay in the

[1] It is true that a highly technical development in preheating by high frequency has made use of a non-dielectric container holding a charge of granular material between the electrodes of an oscillator during the preheating time. This development, however, is still in the experimental stage.

3



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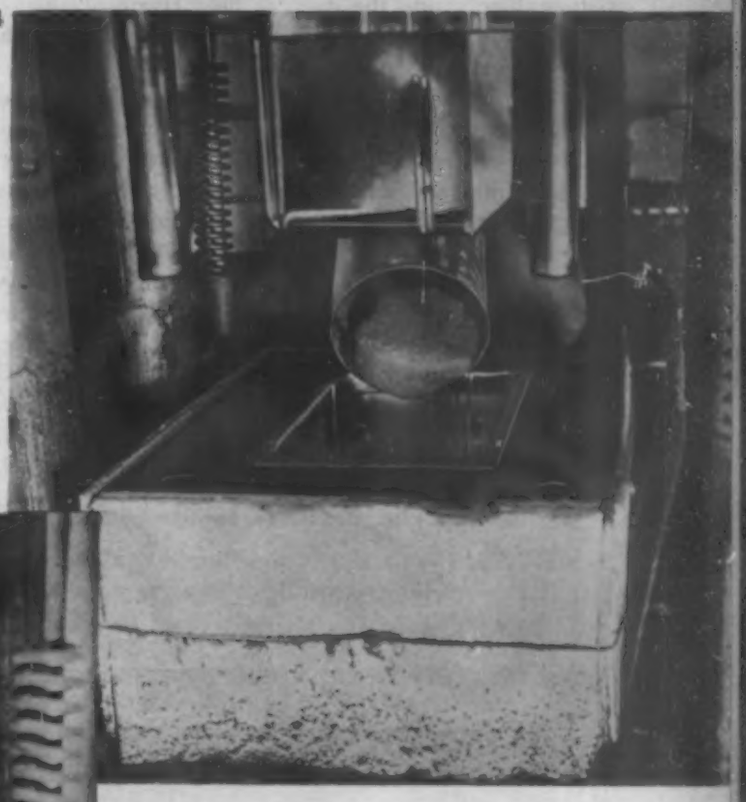
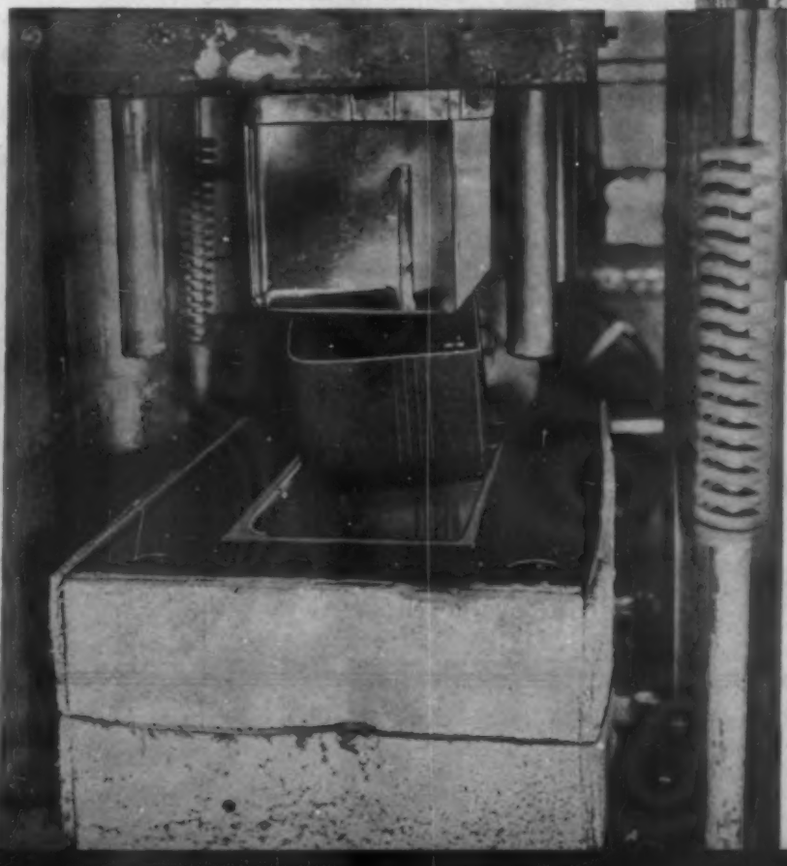


5 ALL PHOTOS. COURTESY MACK MOLDING COMPANY



3—One of the eight preheating containers is loaded into the rotating oven. 4—After the material has been heated for a predetermined time, it is poured into the cavity of the mold. 5—When molding is completed, the finished unit is released from the force plug by knock-out pins. As a final step, the molded piece is placed on shrink blocks

designing of an ingenious oven which eliminates the surface caking that is apparent when a charge of powder is heated in a tray in a normal preheating oven. Set close beside the mold, this unit is capable of preheating eight charges of material at one time.

The outside surfaces of this heater were constructed from a heat-insulating material. Inside were mounted a bank of six large infrared lamps and a rotating device equipped with racks for supporting the eight large metal containers. As can be seen in Fig. 1, a large circular hole was cut in the front wall of this preheater to accommodate a metal disk, mounted on the rotating unit, in which were eight holes with diameters slightly larger than those of the metal material containers. Rotating unit is driven by an electrical motor through a V-belt reduction drive at a speed equivalent to six revolutions of the unit per minute.

When material is placed in the metal containers which, in turn, are placed in the revolving unit, the granular material is insured a uniform preheat since it is continuously agitated by the rotating action. The temperature inside the oven is held thermostatically at 190° F. For the radio cabinet job, this meant a total preheat of 18 minutes for each shot.

To insure against a molder ever making the mistake of removing a container of material before it has had its proper preheat, 45° segments were marked off on the rotating front disk and each segment given a number. Eight hooks, with numbers corresponding to those on the segments, were then attached to the front of the preheating cabinet (Figs. 1 and 3). With this set-up an operator is never in doubt as to which material container should next be removed from the preheater. For example, when a worker takes container No. 3 from the oven, he moves the indicating ring to hook No. 4. When it is time for the next shot, the position of the ring reminds him that No. 4 has been preheated.

From material drum to molded cabinet

In Fig. 1, the molder is weighing out a charge of powder, the suction system being so arranged as to remove the objectionable dust which is always present when powdered phenolic material is poured or handled. In this instance, the charge is for location No. 7, the empty position, in the rotating oven. Once the 1150 grams of powdered phenolic required for one shot is weighed, it is poured into a funnel arrangement which simplifies its transfer to the metal container (Fig. 2).

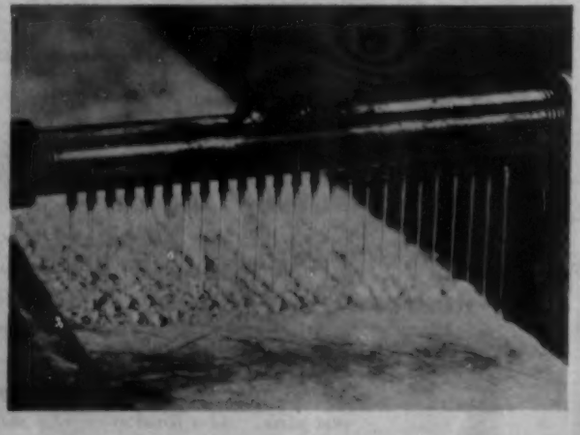
Next the molder places the container in the small rotating oven (at station No. 4 in Fig. 3). In this photograph the container was removed from station No. 5 to show how the racks are positioned to hold the containers firm while the entire unit rotates.

Figure 4 shows the operator loading the mold with a charge of material which has been properly preheated. While the chrome-plated surfaces of the force plug and cavity, which are clearly evident in this picture, are not a requirement for satisfactory molding, they are of considerable help. Having poured the powder from the container into the cavity, the molder distributes this material in a previously determined manner and closes the mold. Cure for this radio cabinet totals 2 min. 20 sec. with a steam pressure in mold cores of 175 p.s.i.

Shrink blocks guard against shrinkage

With the material preheated in this manner, no gassing problems presented themselves. For this reason, the mold can be closed immediately and need not be reopened for gassing. Some plants have found it necessary, when working on a molded part of this size and section, to partially chill the mold before ejecting the part to insure the production of warpage-free pieces. Again, this molder eliminated a time-consuming operation, this time by constructing nine shrink blocks on which the operator places the hot moldings. With nine units provided for the cycle, the parts have time to completely cool and set before they are removed.

While this method of preheating plastic materials, and thereby speeding up the molding cycle, will not be directly applicable to many jobs in the plastics industry, it has potentialities and should be a stimulus for other ingenious, time-saving devices.



A METHOD OF IMPREGNATING FIBERglas mat with resins—so that they soak the material uniformly and in the proper amounts—has been tested and recommended by Owens-Corning Fiberglas Corp.

The resins are held in tanks 3 ft. above the mat and forced by a gear-type pump onto the mat through openings in a series of pipe manifolds. Openings of $1/16$ in., placed $1/4$ in. apart on 1 in. diameter pipe are recommended.

The glass fiber mat should be fed under the perforated pipes, which carry the resin, by means of a conveyor belt.

Tub-Proof, Tot-Proof

THIS Noah's Ark molded of Tenite is excellent proof of the toughness of the material. Tenite easily withstands the banging, dropping, and ungentle treatment to which such a toy is subjected. And the molded Tenite cradle in which the ark rests in dry dock is strong enough to double as a scooter or skate, if the owner so desires.

The buoyant Tenite hull, weighted with metal to prevent it from capsizing, floats easily and is completely watertight. Tenite has low moisture absorption, and water does not mar or dull its lustrous surface.

The Tenite ark is made in cheerful, attractive colors—chocolate brown for the hull, gleaming white for the cabin, and brilliant red for the shingled roof and gangplank. A permanent part of the Tenite, these colors cannot chip or peel.

Tenite is the material of many other favorite playthings—doll heads, whistles, and music makers, toy soldiers, boats, airplanes, and automobiles—all of which may be mass-produced in a minimum of time and at relatively low cost. For information concerning the adaptability of Tenite to your product, write TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

Tenite Noah's Ark molded by Ames Molded Plastics for Amatoy Corporation

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*Melmac - Reg. U. S. Pat. Off. American Cyanamid Company
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Emulsion polymerization of ethylene*

Report presented at 26th Kuko (Plastics Committee) meeting in Ludwigshafen on Feb. 18, 1943, by Dr. Hopff and Dr. Kern, I. G. Farbenindustrie A.-G. This translation prepared by Mrs. I. G. Callomon and Dr. G. M. Kline, National Bureau of Standards

BULK polymerization of ethylene under high pressures, e.g., 1000 atmospheres or more, with oxygen as catalyst was discovered and developed industrially by Imperial Chemical Industries, Ltd. The first chainlike polymers of ethylene, which were completely different from the previously known polymerization products of lubricating-oil characteristics, were produced by this method. The main application of these high molecular weight paraffins of excellent electrical insulating characteristics is in the electrical industry.

Summary

1. Ethylene can very easily be emulsion polymerized using persulfate catalyst, if at least at the beginning of the polymerization the aqueous phase has an alkaline pH value.

2. Metaphosphates have the same action as alkalies. They favor the production of higher polymers.

3. The persulfate forms with ethylene an addition compound which acts as the polymerization nucleus. The formation of this addition compound is promoted by alkalies and metaphosphates. The sulfate group remains attached to the chain molecule.

4. The alkyl sulfate can be hydrolyzed by both acids and alkalies, releasing fatty alcohols. Among these, eicosanol (arachic alcohol) was isolated and identified.

5. There are also present free fatty alcohols, which do not contain any bound sulfur. Hexyl and octyl alcohols were isolated and identified; the presence of unsaturated alcohols was established; glycols or their monosulfates were also observed.

6. The emulsion polymers with a K-value of 25 to 35 have a lower melting point than those produced by the methanol-water-ammonium persulfate process with an average K-value of 18. This indicates that the emulsion polymers have a wider distribution of polymer homologs. A product of this kind is Weichwachs 3647, which has been successfully used in several industrial experiments in the production of stencil papers.

7. The linear polymers can be cross-linked by the action of oxygen, e. g., hydrogen peroxide. This increases the melting point from 90 to 150° C. and higher, depending on the degree of cross-linking.

8. The molecular weight of a thoroughly purified polymer with 1.1 percent sulfur content in the form of sulfate end-groups was 2290; K-value 25.

9. Peroxide catalysts, which are ineffective alone, have an additive action and, as mixtures, give a lively polymerization.

10. A change in the phase ratio of ethylene and water from 1:2 to 1:1 with otherwise unchanged reaction conditions yields a higher percentage of fatty alcohols; at the same time the molecular weight of the polymer decreases.

Bulk polymerization

Since ethylene is a cheap and easily obtainable monomer, its polymerization is economically very interesting due to the great price difference between the monomeric and the polymeric products. It is equally interesting chemically and economically to undertake emulsion polymerization of this compound, the more so because this polymerization would be independent of the I.C.I. process.

But there is another important reason for trying emulsion polymerization of ethylene. Bulk polymerization according to the I.C.I. process is a strongly exothermic reaction (theoretically 830 cal./gram), which takes place at a polymerization temperature of about 180° C. But the monomer and polymer, which must first absorb the liberated heat, are poor heat conductors.[1] An increase in temperature, if kept within limits, will result in polymers of low molecular weight. At higher temperatures an exothermic explosive de-

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[1] $\lambda \cdot 10^3/0° = 15$ for ethylene; $\lambda = 108$ for paraffin.

composition of the ethylene occurs, very often with a rapid increase in pressure as well as decomposition of the polymer, which exists in a critical temperature stage, with the formation of soot, coked products and the like.

It was to be expected that these difficulties would not be encountered if the polymerization took place in emulsion, i.e., in the presence of water which should be well able to absorb the heat of polymerization, thus preventing temperature increases or decompositions.

Numerous experiments were carried out to accomplish this and a patent application was made, claiming that ethylene, alone or in admixture with other polymerizable compounds, will polymerize in aqueous emulsions in the presence of oxygen or oxygen-yielding materials. But with these general instructions it is only in very rare cases possible to emulsion polymerize ethylene and even then these emulsions will be very thin and industrially useless. In view of the practical importance of the problem, the experiments were taken up again after some interruptions and finally brought interesting results (see Fig. 1).

Batch experiments

Practically all simple unsaturated vinyl compounds which can be easily polymerized are asymmetrically substituted ethylenes, e.g., styrene, acrylonitrile, acrylic esters, vinyl chloride and isobutylene, while the corresponding symmetrical ethylenes cannot be polymerized or only with difficulty, e.g., stilbene, symmetrical dichloroethylene and *n*-butylene. Therefore, we had to strive for a *distortion* of the ethylene molecule.

In order to obtain such an effect, the aqueous phase was made alkaline. During the first experiments, potassium oleate was used as catalyst, thus getting an alkaline reaction. It is unimportant whether the aforementioned deduction is correct or not; in any case polymerization occurred during first experiments.

Long cylindrical rotating autoclaves of V_2A steel with a capacity of 5 liters were used for these experiments. The composition of a typical mixture was as follows: 2 liters water, 20 grams potassium persulfate, 7 grams potassium oleate, initial pressure 70 atmospheres at 15° C., time 2 hr. at 120° C., highest pressure 132 atmospheres. The first experiments yielded a stable yellowish emulsion. The polymerization degree was rather low. When the processing was continued in the same autoclave with the same composition, the polymerization degree increased. These first emulsions contained 4 to 5 percent polymer.

During the processing, it became evident that the aqueous medium reacted acid to Congo although at the start of the polymerization it had an alkaline pH value. Since potassium persulfate alone without potassium oleate or other alkaline substances does not cause any polymerization under the same reaction conditions and since, on the other hand, the reaction product reacts acid at the end, these experiments proved that at least at the beginning of the polymerization there must be an alkaline reaction. This fact was further verified in numerous tests. The acid reaction during polymerization develops through decomposition of the potassium persulfate into potassium sulfate and Caro's acid:

$$K_2S_2O_8 + H_2O \rightarrow K_2SO_4 + H_2SO_5 \rightarrow (H_2SO_4 + O)$$

Later on still another process was found which makes it possible to polymerize also in an acid pH phase. This will be discussed later.

The alkaline phase can be maintained, however, during the complete polymerization period if a sufficient excess of alkali is added at the start. Generally speaking, any alkali can be used, such as hydroxides, carbonates, borates or phosphates of the alkali metals, also ammonia and its compounds. In the latter case, byproducts were observed.

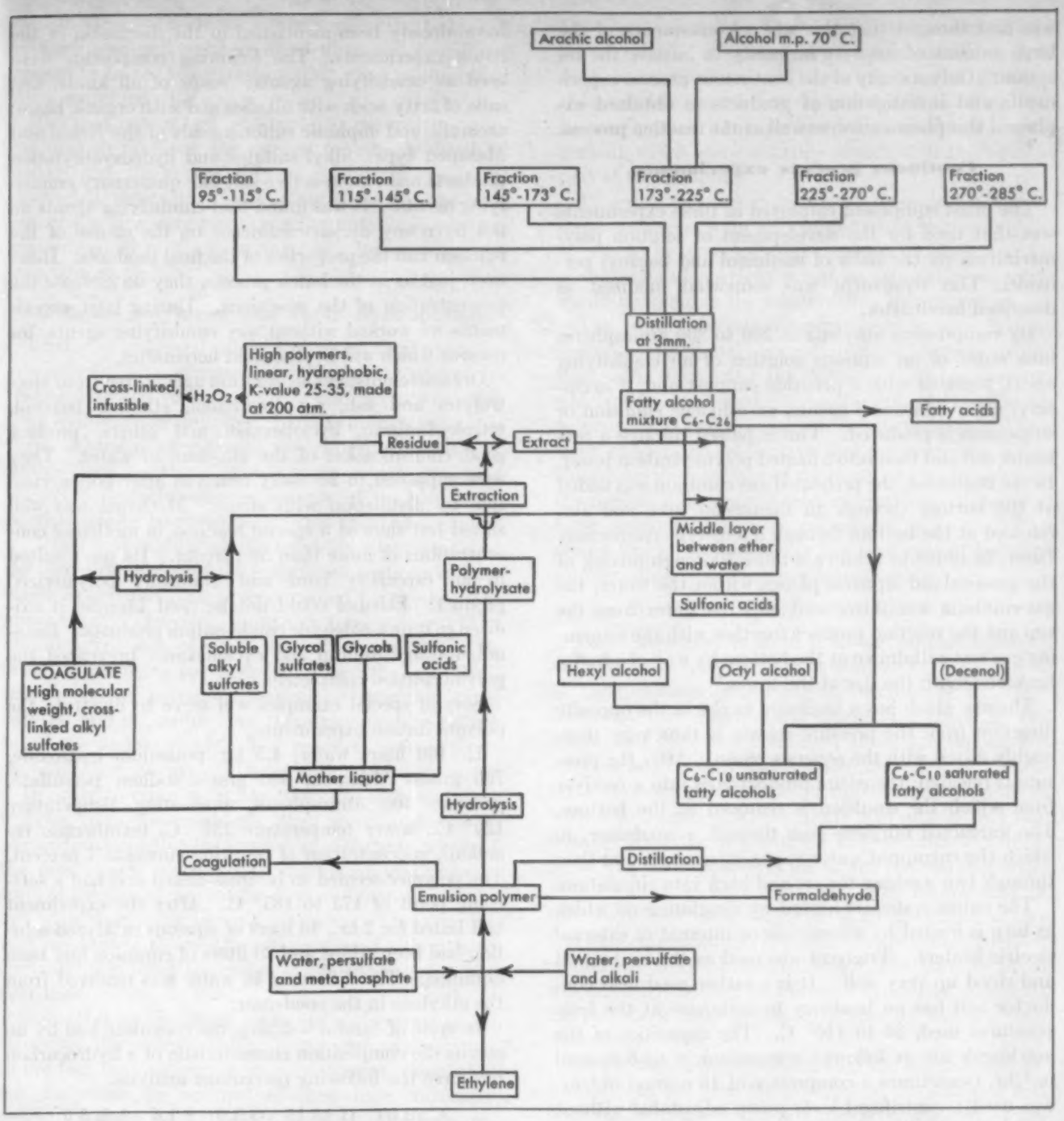
The potassium compounds appear to increase the polymer yield as compared to the corresponding equivalent quantities of sodium compounds. The following solutions were added to two iron high-pressure rotating reactors with a capacity of 1600 $cm.^3$: 500 $cm.^3$ water, 10 grams oxidized paraffin fatty acid (S. Z. 245, 2.6 percent unsaponifiables), 30 grams potassium hydroxide and 20 grams potassium persulfate (or 21.4 grams sodium hydroxide and 17.6 grams sodium persulfate). At room temperature the initial pressure of the ethylene was 200 atmospheres in both cases. The reactors, one of which contained the potassium compounds and the other the sodium compounds, were heated at the same time to a final temperature of 150° C. within 7 to 10 hours. The highest pressure attained was 600 to 800 atmospheres. The following polymer yields in grams were obtained:

Yield with potassium compounds	*Ethylene reacted*	*Yield with sodium compounds*	*Ethylene reacted*
grams	*%*	*grams*	*%*
125	28.0	82	18.4
144	32.4	88	19.8
220	49.5	68	15.3
93	21.0	80	18.0
110	24.8	84	18.8

For the last three comparative compositions the reactors were interchanged after thorough cleaning so that no incidental catalytic influences could be attributed to their walls.

The numerous batch experiments made in VA rotating autoclaves to investigate the effects of emulsifying agent, pH value, time, temperature, pressure, etc., will not be described in detail.

One of the experiments in this series should be described as to the conditions under which the reaction took place and the yield: 1.5 liters water, 30 grams potassium hydroxide, 20 grams Mesapon, 30 grams sodium persulfate, initial pressure (ethylene) 78 atmospheres, initial temperature 15° C., Holten ethylene 94.5 percent, time 4 hr., highest temperature 70° C., highest pressure 165 atmospheres, polymer yield 170 grams which is 15.7 percent of the ethylene.



1—*Emulsion polymerization of ethylene*

During another experiment with the same composition the polymerization started at 86° C.; the temperature increased to 112° C. as a consequence of the heat of polymerization and the pressure decreased at the same time from 220 to 210 atmospheres. The yield was 145 grams which is 13.1 percent of the ethylene. This experiment shows very well how the water, in which the reaction occurs, absorbs so much of the heat of polymerization as the reaction proceeds that even with an absolute temperature increase the pressure decreases. A similar reaction during bulk polymerization by the I.C.I. method under corresponding circumstances would have resulted in a very high pressure increase and undesirable accompanying phenomena.

The general conclusions resulting from these batch experiments are as follows: 1) With increasing alkalinity cross-linking increases. 2) With decreasing alkalinity cross-linking decreases and the polymers become softer. 3) The use of emulsifying agents increases the concentration of the resulting emulsions.

Practically all the polymers were found to be cross-linked; they did not give clear solutions in aliphatic hydrocarbons, did not yield clear melts and had high melting or softening points up to 200° C. and more. It

was first thought that this was a consequence of the large amount of catalyst necessary to initiate the reaction. Only a study of the continuous process experiments and investigation of products so obtained explained this phenomenon as well as the reaction process.

Continous process experiments

The plant equipment employed in these experiments was that used for the development of solution polymerization on the basis of methanol and benzoyl peroxide. This equipment was somewhat modified as described hereinafter.

By compressing ethylene at 200 to 300 atmospheres into water or an aqueous solution of an emulsifying agent, together with a peroxide catalyst and, if necessary, other additional agents, an ethylene emulsion or suspension is produced. This is passed through a preheater coil and then into a heated polymerization tower. In the beginning, the preheated gas emulsion was added at the bottom through an immersion tube and also released at the bottom through a lens-type connection. Later, in order to achieve a more thorough mixing of the gaseous and aqueous phases within the tower, the gas-emulsion was introduced into the tower from the top and the reaction product together with the remaining gas was withdrawn at the bottom by way of a buffer tank one-tenth the size of the tower.[1]

The gas which has a tendency to rise in the opposite direction from the pressure release is thus very thoroughly mixed with the aqueous phase. After the pressure is released, the entire product goes into a receiver from which the emulsion is removed at the bottom. The unreacted ethylene goes through a condenser, in which the entrapped water vapor is removed, and then through two washing towers and back into circulation.

The entire system is heated by circulating oil which in turn is heated by steam coils or internal or external electric heaters. Triglycol was used as the heating oil and stood up very well. It is a rather good heat conductor and has no tendency to carbonize at the temperatures used, 80 to 140° C. The capacities of the machinery are as follows: compressor, 6 to 8 normal m.³/hr. (sometimes a compressor of 18 normal m.³/hr. was used); centrifugal lever pump adjustable without stages, 8 to 80 liters/hr.; preheater, an approximately 30 meter pipe with a diameter of 10 mm.; tower, 10 liter content. The polymerization pressure was 200 to 300 atmospheres.

Numerous experiments on the continuous process showed that a higher concentration of catalyst is necessary, generally 0.6 to 2 percent of the aqueous phase. In general, the compositions for the continuous method were as follows: 100 liters water, 0.25 to 2 kg. alkali, 0 to 1.5 kg. emulsifying agent, 0.6 to 2 kg. peroxide compound. The alkaline-reacting substances used have already been mentioned in the discussion of the batch experiments. The following compounds were used as emulsifying agents: soaps of all kinds, i.e., salts of fatty acids with alkalies and with organic bases; aromatic and aliphatic sulfonic acids of the Nekal and Mesapon type; alkyl sulfates and hydroxyethylation products and cation-active salt-like quaternary emulsifying agents. It was found that emulsifying agents do not have any decisive influence on the course of the reaction and the properties of the final products. However, just as in the batch process, they do increase the concentration of the emulsions. During later experiments we worked without any emulsifying agents, for reasons which will be discussed hereinafter.

Organic emulsifiers as solution agents free from electrolytes and ash, e.g., methanol, ethanol, butanol, tetrahydrofuran, cyclohexanol and others, produce good emulsification of the ethylene in water. They were supposed to be easily removed after polymerization by distillation with steam. Methanol was well suited but showed a special reaction in methanol concentrations of more than 50 percent. Its use resulted in an especially hard and uniformly polymerized product. Ethanol could not be used because it oxidized to brown aldehyde condensation products. Butanol, tetrahydrofuran and cyclohexanol prevented the polymerization completely.

Several special examples will serve to illustrate the polymerization experiments.

1. 100 liters water, 1.5 kg. potassium hydroxide, 700 grams Mesapon, 600 grams sodium persulfate, pressure 300 atmospheres, preheating temperature 120° C., tower temperature 130° C. (exothermic reaction), concentration of resulting emulsion 7 percent. The polymer seemed to be cross-linked and had a softening point of 173 to 185° C. After the experiment had lasted for 2 hr., 40 liters of aqueous catalyzed solution had been added and 30 liters of emulsion had been obtained. The difference in water was removed from the ethylene in the condenser.

In spite of careful washing, the coagulate had by no means the composition characteristic of a hydrocarbon but gave the following percentage analysis:

C 78.09 H 13.15 O 3.9 S 1.6 Ash 5.0

2. 100 kg. water, 4 kg. potassium hydroxide (50 percent), 2 kg. paraffinic fatty acid, and 2 kg. sodium persulfate, preheating temperature 84 to 100° C., concentration of resulting emulsion 20.2 percent, ethylene reacted 15 percent. After thorough dialysis and subsequent washing with water and methanol, elementary analysis gave the following percentage data:

C 80.70 H 13.57 O 3.3 S 1.2 Ash 3.2

These emulsions as well as the coagulates made from them were sent away to determine possible uses. The different I. G. laboratories reported that neither the emulsions nor coagulates could be used in their present form. One application was found for which the polymers were well suited, i.e., as a wax component for

[1] Lately, the equipment has been modified further. The original tower was retained and two more were added. The gas-emulsion enters through an immersion tube in the upper third of each tower. The emulsion is released at the bottom and the unused gas at the top. In this way the reaction in the tower can be better controlled and the reaction time can be lengthened. In order to increase the output, the towers can be arranged in series; in this case, in order to increase the temperature and utilize the catalyst more completely, the middle tower has external electric heating. The used gas can be replaced by fresh gas in the second or third tower.

stencil paper. In all the other application tests, the emulsions as well as their dried films and coagulates proved to be too sensitive to water; they re-emulsified when sprinkled with water.

The next urgent task was to clarify the reaction process and to find out the causes for the hydrophilic nature and the reversibility of coagulated emulsions connected therewith. Only after these strange phenomena, which were contrary to expectations, were explained, could products having much better properties be produced.

Emulsion polymers and their hydrophilism

First, the dispersed phase had to be thoroughly investigated. The aforementioned analyses proved by their sulfur and oxygen content that there was more than hydrocarbons involved. It was first thought that there existed a very strong absorption of sulfates or sulfate ions to the disperse phase which possessed strongly absorptive powers because of its very small particle size or large surface. This could also explain a certain reversibility of the emulsion coagulates, i.e., the direct resolution of the coagulated particles in pure water as a peptization process caused by the bivalent anion $SO_4^{=}$. Therefore, numerous tests were made to obtain a polymer of approximate hydrocarbon character[3] by changing the composition and the test conditions, such as pressure, temperature, reaction time, catalyst and pH value. All these experiments did not bring the desired result. The product, even if rigorously cleaned, always contained sulfur and oxygen.

In order to remove the last traces of salts and electrolytes from the emulsions, they were subjected to electrodialysis. But the result was that the contents of the middle cell continued to react acid to Congo in spite of passage of current for days and increasing voltage with decreasing current intensity. The strongly acid reaction of the middle cell continued although no electrolytes entered the cathodic and anodic cells after that time.

Since this composition contained only soap as an emulsifier, the cause for this phenomenon was attributed to the fact that *sulfonic acids* were present which were not dialyzable on account of their high molecular weight; sulfuric acid should have long since been removed by the dialysis. But these *sulfonic acids* could have developed during the course of the reaction only from the single sulfur component present—which is the persulfate.

If this assumption was correct, the *sulfonic acids* of medium molecular weight (about 200 to 400) should decrease the surface or interfacial tension of the water. By means of an investigation with a stalagmometer, this assumption was verified. In order to eliminate all sources of error, the equipment was thoroughly cleaned and several mixtures were run through without any emulsifying agent. The aqueous phase consisted of 100 liters water, 1 to 2 percent persulfate and 0.5 to 2 percent alkali. As usual very good emulsions resulted. In a stalagmometer with a water value of 53 drops these emulsions gave drop numbers of 90 to 106. Thus it was proved that surface-active substances were present which were actually dissolved in the aqueous part of the emulsion.

In order to learn more about these *sulfonic acids*, these emulsions were also subjected to electrodialysis.[4] It was to be expected that the *sulfonic acids* that are of low molecular weight would be permeable, therefore would be found in the anodic cell of the apparatus.

The readily diffusible inorganic acids were first removed by fractional electrodialysis at low voltage and then, after increasing the voltage, the anodic waters which now contained the more difficultly diffusible *sulfonic acids* were collected by themselves. These were evaporated to isolate and examine the acids. But under the influence of the remaining hydrogen ions, the *sulfonic acids* decomposed and suddenly the odor of fatty alcohols developed, corresponding to C_6. *This proved that no sulfonic acids had been present but alkyl sulfates*, since only these are hydrolyzable.

$$R{-}OSO_3H + H_2O \rightarrow R{-}OH + H_2SO_4$$

These were now isolated from the mother liquor of the emulsions coagulated with methanol; they showed all the properties of fatty alcohol sulfonates, i.e., foam formation and washing and emulsifying powers. The coagulated part also contained these substances, but they were of much higher molecular weight. These fatty alcohols could also be obtained through hydrolysis with 1 to 2 percent hydrochloric acid and in part also isolated from the precipitated mixture and identified. That was the explanation for all the strange properties of the emulsions and the films. The reversibility of the coagulated emulsions and the hydrophilic nature and easy emulsification of the films were caused by their content of fatty alcohol sulfates. The counter proof was given by the fact that films of *hydrolyzed* emulsions did not show these undesired properties and are very resistant to water.

Here it should be mentioned that the steam distillate, which developed after the pressure on the emulsion had been released, also contained free fatty alcohols of the approximately C_6 to C_{10} series.

Origin of alkyl sulfates and free fatty alcohols

There is not the slightest doubt that the alkyl sulfates are formed from ethylene and persulfate, e.g., hexyl sulfate is formed from three molecules of ethylene which are linearly polymerized and one molecule of sulfuric acid. The individual reactions probably occur as follows:

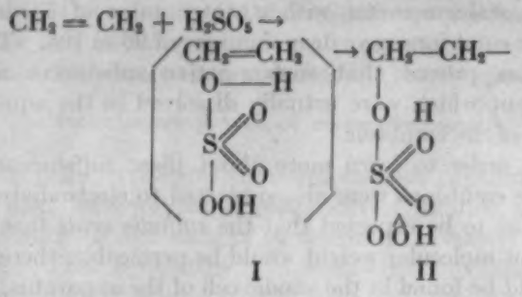
$$K_2S_2O_8 \rightarrow K_2SO_4 + SO_3{\cdot}O$$
$$SO_3{\cdot}O + H_2O \rightarrow H_2SO_5 \text{ (Caro's acid)}$$

A. This acid (or one of its salts) may add itself to

[3] A *pure* hydrocarbon could hardly be expected because the I.C.I. patents concerning block polymerization of ethylene state that the polymers contain oxygen. This occurs through entry of the catalytic oxygen into the molecule. The oxygen content of one of the British polymers was 0.21 percent, but it can go to 1 percent or more.

[4] The apparatus of the Firm Boehme, Leipzig, was used; the diaphragms were parchment paper; 220 v. direct current, initial tension 50 v. increasing to 170 volts.

an ethylene molecule by means of a single primary valence.



I II

This reaction is favored by the presence of an alkali. This primary reaction product disintegrates at the reaction temperature, i.e., between 80 and 120° C., with splitting off of the relatively labile peroxide oxygen, which then acts as polymerization catalyst for the chain growth. This activated molecule now serves as the polymerization nucleus of the chain in that the double bond disappears and the freed valence bond attacks the nearest ethylene molecule. Thus the chain will grow until it is brought to an end, for instance, by the free hydrogen atom previously indicated (II). This loosening of hydrogen atoms may be restricted by the nascent oxygen or by kinetic conditions at the time of the decomposition of the starting molecule.

The freed oxygen can also take part in secondary reactions, two of which were observed, as follows:

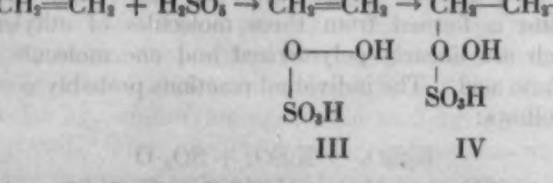
1. During polymerization, formaldehyde is always present caused by oxidation of ethylene:

$$CH_2{=}CH_2 + O_2 \rightarrow 2CH_2O$$

The amount of formaldehyde formed is 0.6 to 0.7 percent of the weight of the polymer.

2. The pure polymerization should only result in saturated compounds regardless of how the nuclear molecule is formed or how the chain is broken. But unsaturated polymers of ethylene were also found, e.g., unsaturated fatty alcohols. Although there is no precise proof, it can be stated in all probability that the nascent oxygen will cause dehydrogenation. Of course, it is not necessary that the oxygen split from the compound of ethylene and persulfate is solely responsible for these reactions; the free potassium persulfate can act directly as an oxidizing agent.

B. There is also the possibility that Caro's acid may add to ethylene in such a way that the sulfate group goes to the first carbon atom of the ethylene and the peroxide hydroxyl group to the second:



III IV

This molecule also disintegrates at the reaction temperature, releasing the hydroxyl group which serves to break the chain reaction by the formation of glycols or their sulfates. As a matter of fact, glycols or their sulfates were found, but from this fraction no specific glycol has been isolated so far because a complex mixture is also involved here.

The formation of normal alkyl sulfates is the most outstanding side reaction. The aforementioned reaction process might also be the explanation for the observations made in Schkopau during the persulfate polymerization of vinyl chloride. A small decrease in the surface tension had been observed, as well as the good emulsification properties of emulsions produced without emulsifying agents. It was called "hardly doubtful" that the sulfur was transformed into a sulfonic group. But the results of the experiments made there appear in the case of vinyl chloride, at least, to be against a correlation between nucleus formation and the formation of sulfonic groups.

It is very probable that the reaction of vinyl chloride occurs exactly as that of ethylene. An indication of this is the favorable influence of ammonium ions. Therefore, no sulfonic group formation took place but rather sulfate compound formation. Hydrolysis would serve to confirm the parallelism between vinyl chloride and ethylene, if the chlorine of the polyvinyl chloride could withstand this requirement. The same reasoning will apply to the persulfate emulsion polymerization of acrylic esters and styrene.

After the fundamental reaction which leads to polymerization of the simplest monomer—ethylene—has been clarified, the characteristics of polymerization brought about by catalysts, especially that of emulsion polymerization, can be studied generally. It is of advantage that the ethylene polymers with varying end groups can be easily isolated; that they belong to different classes of compounds; that before hydrolysis they are characterized by sulfur and oxygen, after hydrolysis by oxygen content; and that ethylene neither in its monomeric nor in any of its polymeric forms undergoes any secondary reaction which would interfere with confirmation of the course of the reaction.

The following component parts were found in the emulsions (without hydrolysis):

1. Alkyl sulfates of very low to very high molecular weights.
2. Free fatty alcohols.
   a. Saturated.
   b. Unsaturated.
3. Glycols or glycol sulfates.
4. Sulfonic acids.

Sulfur balance from potassium persulfate

In order to get a general picture of the consumption of potassium persulfate during polymerization, the relationship between added sulfur and polymer-bound sulfur was determined. Here are two examples:

First composition—Alkaline polymerization: 100 liters water; 1.6 kg. potassium persulfate; 4 kg. potassium hydroxide (50 percent); 2 kg. Mesapon; pressure, 190 atmospheres; preheating temperature, 113° C.; tower temperature, 121° C. Input: 47 kg. of solution. Yield: 40 kg. of emulsion with 13.9 percent polymer content.

The polymer was coagulated with methanol, redissolved in water and again coagulated. It was treated in this manner for a total of eleven times, then extracted several times with toluene and then twice with benzine. Yield of polymer, 5550 grams (K-value 25); sulfur content, 1.1 percent; bound sulfur, 61 grams; added sulfur from $\frac{K_2S_2O_8}{2}$, corresponding to the amount of Caro's acid, 89.2 grams. Thus, 68.4 percent of the persulfate sulfur was taken up by the ethylene and utilized for the polymerization.

Second composition—Acid polymerization: this composition was processed without emulsifying agent or alkali by adding sodium metaphosphate, which made possible polymerization in the acid pH range: 100 liters water; 1.6 kg. potassium persulfate; 1.5 kg. sodium metaphosphate; pressure, 200 atmospheres; preheating temperature, 120° C.; tower temperature, 125 to 130° C.; pH value before the reaction, 6; pH value of the finished product, 3. The emulsion had a concentration of 6.2 percent. Input: 1.6 kg. potassium persulfate = 189 grams sulfur. Polymer yield: 5450 grams (K-value 24.5) of 2 percent sulfur content = 109 grams sulfur. Degree of utilization of persulfate sulfur: 57.7 percent.

The utilization degree is comparatively high, especially in view of the fact that the finished emulsion still contains active oxygen, because the persulfate cannot completely react in the relatively short reaction time. This fact also caused us to modify the apparatus as previously described. Of course, some sulfur is taken up by the polymers of low molecular weight which are removed during the purification process. This high degree of utilization of the sulfur indicates to the observer that to a large extent one macromolecule is formed from one molecule of monomeric adduct catalyst·olefin.

Our own further tests with the di-olefins showed that for these the conditions are somewhat different. It was found that commercial Buna S, which is produced with comparatively large amounts of persulfate, has very few end groups. It must still be determined whether this is the result of the formation of very large polymer molecules with consequent few end groups or whether the activation of di-olefins is different from that of ethylene. On the other hand, it seems that in the case of butadiene several macromolecules are formed from one adduct.

Degree of polymerization from the end group

In most cases the reaction occurs as follows: the nuclear molecule—ethylene persulfate—initiates the polymerization, and other ethylene molecules add linearly to this ethylene sulfate radical. The final molecule is, therefore, according to the degree of polymerization, a more or less long chain which, if the reaction took place in the alkaline range, has a —OSO_3K group at its origin. After purification of such a high molecular weight polymer with water, methanol, toluene and benzine, it could be assumed that one molecule of polymer will correspond to one atom of sulfur.

The analytical data for the sulfur-containing polymers of high molecular weight are given in Table I. On the basis of the sulfur content, a molecular weight of 2900 is calculated. Deducting for the group OSO_3K (2900−135), the degree of polymerization is calculated to be 98 to 99, on the assumption that one molecular chain has one sulfate group. (In case the molecule should be formed through the combination of the chains of two such radicals, the molecular weight must be doubled.)

The molecule thus computed has the formula:

$$(CH_2—CH_2)_{99}OSO_3K$$

For this formula the carbon value is a little low and the oxygen value a little too high, namely, 0.5 and 0.8 percent, respectively. This would indicate that small amounts of glycol-like compounds of high molecular weight are present which are not removed by the purification operations. But this fact has no influence on the determination of the molecular weight from the final sulfur group. The K-value of the product was 25, determined in xylene at 75° C.

Properties of the hydrolyzed polymers

Almost all the polymers obtained by coagulation at the beginning of this investigation were found—as mentioned before—to be cross-linked. They did not give clear melts when heated but only sintered together. The softening point (Kraemer-Sarnow) was between 120 and 200° C.

The reason for this behaviour is that the polymers are not hydrocarbons, but are *salts* of alkyl sulfates. The hydrolyzed polymers show quite different properties. When heated they give clear melts which can be drawn out into filaments and give clear solutions when heated in aliphatic hydrocarbons. No cross-linking was noticed with normal compositions. The K-value is between 25 and 35. The products can be easily rolled into foils and films, but these have poor strength. The melting point is between 75 and 100° C.

Even after the fatty alcohols of low molecular weight have been separated by boiling with butanol and the solvent has been removed at 100° C., the product is not a uniform polymer. As far as its properties are con-

Table I.—Analytical Data for Emulsion Polymerized Polyethylene

	C	*H*	*O*	*S*	*Ash*
	%	%	%	%	%
After solution 11 times in pure water and subsequent precipitation with methanol	80.61	13.55	2.9	1.2	3.3
After extraction with toluene	80.21	13.64	3.1	1.2	3.2
After extraction with benzine	80.21	13.34	3.3	1.2	3.2
After another extraction with benzine	81.11	13.69	3.0	1.1	Not determined

Table II.—Properties of Polyethylenes

	I. Lupolen N	*II. Ammonium persulfate polymer in aqueous methanol*	*III. Emulsion polymer*	*IV. Lupolen H*
Melting point, ° C.	105 to 108	110 to 112	95	110 to 115
K-value, average	18	18	35	75

cerned, the polymer is between Lupolen N and Lupolen H, but is probably formed from macromolecules of greatly varying sizes. Table II illustrates differences:

I in Table II is a little softer than II, with a lower melting point, but with the same K-value. In spite of this, the polymer size distribution degree is wider.

II in Table II is a brittle product, very uniformly polymerized, i.e., the molecular chains are of approximately the same size.

III in Table II is considerably softer than II, has a lower melting point but a much higher molecular weight and contains enough high molecular weight material to form films. The polymer is very non-uniform.

IV in Table II is the product of the highest molecular weight, has definite plastic characteristics and seems to be rather homogeneously polymerized.

Additive reaction of peroxide catalysts

In an endeavor to obtain polymers of higher molecular weight, several series of experiments were made. The amount of persulfate was reduced for this purpose in order to give as few centers of attack as possible and thus obtain a higher polymeric chain.

It became evident that with a reduction of the amount of catalyst, the polymerization degree did not substantially increase. This would indicate that under the present reaction conditions the concentration of the catalyst in the aqueous phase is of great importance. The minimum amount of persulfate which under normal conditions will start polymerization is approximately 0.3 to 0.4 percent, based on the aqueous phase. But in this case the emulsions will be too thin.

No emulsions were obtained with ammonium perphosphate with one exception. Careful investigation showed that in this case the apparatus, in spite of being well washed, had retained some traces of persulfate from the preceding day. Further work showed that a mixture of both catalysts will cause perfect polymerization, although each individual component is completely ineffective in the same or even in a higher concentration. That is, 0.2 percent of potassium persulfate produces no emulsion formation, nor does 1 percent of ammonium perphosphate. Both, combined, result in a beautiful polymer emulsion of 6.5 percent content.

Polymerization in acid aqueous phase

It has been mentioned previously that polymerization can take place in the acid phase. The polymeric phosphates act exactly as alkalies; namely, that as auxiliary catalysts they enable the persulfates to react as polymerizers. Neither the persulfates nor the metaphosphates alone are capable of starting the polymerization. In the usual compositions, 0.5 to 1 percent of sodium tri- or hexametaphosphate, based on the aqueous phase, is added in place of an alkali. This makes it possible to polymerize in the pH range 2 to 6. The polymers obtained also contain sulfur and after hydrolysis yield linear polymers similar in properties to those obtained with alkalies. However, less fatty alcohol and proportionately more higher molecular weight polymer is formed.

Since the marked complex-forming properties of the metaphosphates probably play a role, other polymeric compounds which also form complexes should be investigated as to their effectiveness as catalysts, such as polyborates and possibly also polysilicates.

The polymerization reaction with metaphosphates was in most cases so lively that the apparatus became clogged by the precipitated polymer in the absence of an emulsifying agent. When particles which had been lodged for some hours in the apparatus were removed, analysis proved that they were cross-linked. This genuine cross-linking cannot be removed by hydrolysis.

It was suspected that this phenomenon was the result of a secondary reaction since the emulsified polymer of the same composition was completely free of cross-linking. The chemicals causing this phenomenon could be either oxygen or formaldehyde, both of which are present in the aqueous phase.

A control experiment was made to investigate the action of oxygen. Hydrolyzed polymer completely free of cross-linking was used, made from the following mixture: 100 liters water; 1 kg. sodium persulfate; 1 kg. sodium hexametaphosphate; 0.9 kg. Mersolat D; pressure, 205 atmospheres; preheating temperature, 117 to 121° C.; tower temperature, 138° C.; concentration of resulting emulsion, 6.8 percent. The pH value decreased during the reaction from 5 to 3.

In order to split off the sulfate groups, the emulsion was hydrolyzed in the following manner: 1 kg. emulsion; 200 cm.³ concentrated hydrochloric acid; 4 hr. boiling time under reflux; then filtering with suction and washing to free from electrolytes. Yield: 68 grams of polymer. The latter was repeatedly boiled with butanol in order to remove the component of low molecular weight. This amounted to 8 grams of a pale yellow substance, very similar to wool grease with respect to its hydrophilic nature and consistency.

The remaining polymer had a K-value of 25.3 as measured in ethylpyrrolidone and an oxygen content of 1 percent. It was not cross-linked, gave a clear melt and could be drawn out into filaments. This product was well stirred at 100° C. for about 10 min. with 10 to 15 percent, based on its weight, of 33 percent hydrogen peroxide and then heated in a vacuum for 3 hr. at 130° C. to remove the free oxygen as completely as possible. This product was completely cross-linked and infusible. Because of (*Please turn to page 206*)

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General

SILICONES AS LUBRICANTS. T. A. Kauppi and W. W. Pedersen. SAE J. *54*, 120–4 (March 1946). Silicone fluids may solve lubrication problems involving heat stability, oxidation resistance, nonvolatility and low change of viscosity with change in temperature. Different types of silicone fluids vary in their lubricating ability and behavior toward various rubbing metal surfaces. Some of the silicone fluids approach petroleum oils in ability to reduce wear. Silicone greases, because of their oxidation resistance and low volatility, should be applicable to ball bearings under severe conditions and in permanently lubricated ball bearings where long service life is essential.

THE PLASTICS INDUSTRY IN AUSTRALIA. British Plastics *18*, 115 (March 1946). This is a brief review of the current position of the plastics industry in Australia. The bulk of the imports of thermosetting molding materials was from the United Kingdom and of the thermoplastic molding materials from the U. S. A. in 1944.

PLASTICS IN THE REICH. R. E. Richardson. Can. Plastics *4*, 11–17 (March 1946). This is a review of the equipment, processes and plastic materials used by the Germans. Various applications are described.

RUBBER INDUSTRY NEEDS NEW CHEMICALS. M. J. DeFrance. Chemical Industries *58*, 426–8, 492 (March 1946). The needs of the rubber industry for better plasticizers, plasticizing agents, solvents, reclaiming oils, pigments, accelerators, antioxidants and adhesives for the new synthetic polymers are discussed.

CELLULOSIC MATERIALS AND THE PLASTIC INDUSTRY. S. W. Blake. Pulp Paper Mag. Can. *46*, 925–7 (1945). Recent developments in the use of wood, wood pulp and paper in the manufacture of plastic materials are reviewed in this article.

PLIMBER. British Plastics *18*, 82–4 (Feb. 1946). Modern Plastics *23*, 108–110 (March 1946). Low-priced plastic boards made by bonding sawdust, straw and other waste fibers with synthetic resin are described. The densities vary from 35 to 60 lb./ft.^{3}, the tensile strengths from 500 to 2000 p.s.i., the flexural strengths from 500 to 2800 p.s.i., and the compressive strengths up to 4200 p.s.i. It is recommended for the construction of buildings and furniture.

ADVANCES IN RUBBER DURING 1945. E. G. Chilton. India Rubber World *113*, 513–16 (Jan. 1946). Advances in the rubber industry in 1945 are reviewed. One hundred and seventy-eight references.

NYLON PRODUCTION TECHNIQUE IS UNIQUE. J. A. Lee. Chem. & Met. Eng. *53*, 96–9 148–151 (March 1946). The production of nylon is described. Nylon salt, hexamethylene diammonium adipate, is made at Belle, W. Va., and shipped to the two producing plants in water solution in tank cars. At these plants, the water is evaporated and the material polymerized. The polymer is extruded onto a casting wheel, chipped, blended, melted, spun and drawn. A flow sheet for the process is included.

Materials

CELLULOSE ACETATE ESTERS CONTAINING AMINO NITROGEN. T. S. Gardner. J. Polymer Sci. *1*, 121–6 (March 1946). Nitrogen was introduced into cellulose acetate by the incorporation of amino acid groups. Some of the mixed esters were soluble in organic solvents. Cast films were examined for dyeing properties with wool-type dyes. Many of the mixed esters containing above 1 percent nitrogen dyed well with xylene brilliant blue, a typical wool-type dye. Mixed cellulose acetate esters were synthesized containing glycine, *dl*-α-alanine, β-alanine, and α-isoaminobutyric, *d*-glutamic, and *p*-aminobenzoic acids. The amino groups were protected by acetylation prior to use. The N-acetyl amino acids were treated with cellulose diacetate in dioxane solution containing chloroacetic anhydride and magnesium perchlorate as impellor and catalyst, respectively. Cellulose acetate metanilate was prepared by use of the aminosulfo acid chloride. An attempt was made to prepare 6-aminocellulose by the reaction of aqueous ammonia, and also sodamide in liquid ammonia on 6-iodotosylcellulose acetate. Only traces of nitrogen were introduced by this procedure and the recovered products showed signs of extreme degradation.

COCONUT PRODUCTS AND THE PLASTICS INDUSTRY. G. B. E. Schueler. Plastics (London) *10*, 84–90 (Feb. 1946). The coconut can provide three distinct products for the plastics industry, namely, coconut shell flour, coir dust and coir fibers. The composition and properties of these materials are discussed. Large quantities of these materials are available as by-products of the coconut industry. Six references.

SILICONES—MIRACLE OF MOLECULE ENGINEERING. C. A. Scarlott. Westinghouse Engr. *5*, 130–4 (1945). The synthesis, properties and applications of the silicones are reviewed.

FOSTERITE, A MOISTURE-PROOF INSULATION. E. L. Schulman. Westinghouse Engr. *5*, 184–6 (1945). Thermosetting insoluble resins consisting of copolymers of alkyd and vinyl types are described. They may be used as moisture-proof insulation materials.

COLORING OF PLASTICS. C. R. M. Oehlcke. J. Soc. Dyers Colourists *61*, 306–10 (1945). Plastics are colored by 1) dyeing the surface, 2) coating the surface with a lacquer, 3) incorporating soluble dyes and 4) incorporating insoluble pigments. The best method for coloring plastics is incorporation of insoluble lakes and pigments.

PRELIMINARY STUDIES ON IMPROVED COMPREGNATED WOOD. D. Narayanamurti and K. Singh. Forest Research Inst. Dehra Dun, Indian Forest Leaflet No. *77*, 11 pp. (1945); Chem. Abstracts *40*, 1003 (Feb. 20, 1946). The properties of materials made by bonding resin-impregnated wood veneers at high temperatures and high pressures are reported. The resins used include tar acid-formaldehyde, prolamine-formaldehyde, casein-formaldehyde and combinations of these. Tensile strengths of 40,000 p.s.i. and over were obtained.

SOL-GEL TRANSFORMATIONS OF WATER-SOLUBLE ETHYLATED HYDROXYETHYLCELLULOSE. S. Sönnerskog. Svensk Papperstidn. *48*, 413–16 (1945); Chem. Abstracts *40*, 458 (Jan. 20, 1946). Aged alkali cellulose solutions are treated with ethylene oxide and ethyl chloride to produce ethylated hydroxyethylcellulose. These mixed esters are soluble in water. The gelation temperature increases with decreasing viscosity which in turn decreases with an increase in the time of aging of the alkali cellulose.

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Akad. Nauk S.S.S.R., Otdel. Khim. Nauk i Otdel. Fiz.-Mat. Nauk *1*, 37–40 (1943); Chem. Abstracts *40*, 495 (Jan. 20, 1946). The bond between cellulose and lignin is acetal in character. Hydrolysis of this bond causes plastification of the wood. Compounds which resinify with aldehydes tend to make wood thermoplastic. Birch wood can be made thermoplastic by treating chips with dilute alkali and then with a solution of dicyanodiamide. Cellulose will not react if treated under the same conditions as the birch.

Applications

RAILWAY PLASTICS. W. Nichols. British Plastics *18*, 33–9, 56–64 (Jan., Feb. 1946). This is a review of the applications of plastics in railway equipment including future possibilities. Some of the applications considered are 1) laminates and plywoods for walls, panels, doors, table tops and bedheads, 2) lighting fixtures, 3) track insulators, 4) sign panels, 5) low-temperature heating panels, 6) pulleys, 7) upholstery, 8) flooring, 9) curtains, 10) lamp shades, 11) insulating materials of expanded plastics, 12) toilet fixtures, 13) instrument panels, 14) knobs, 15) battery housings, 16) adhesives for metal to metal and metal to wood, and 17) piping. Applications to rolling stock, track, shops, offices, stations, and signal systems are described. Types and forms of plastics are suggested for use in the various applications.

GEON IN THE WIRE AND CABLE INDUSTRY. G. A. Fowles. Rubber Age *58*, 703–8 (March 1946). The application of vinyl plastics for wire and cable insulation is discussed. The extrusion of these materials and their properties are described. Their flameproofness, light weight, high dielectric strength and resistance to oil and aging are superior to natural rubber so that in the great majority of applications of insulated wire and cable the vinyl plastics will be preferred.

CRAFTWORK IN SCHOOLS. British Plastics *18*, 127–32 (March 1946). The use of plastic scrap and wood in handicraft for making boxes of all kinds, jewelry, ornaments, many types of cases, book-ends, art objects, frames, trays, lamp stands, knife handles, chests and small tables.

MELAMINE RESINS FOR THE DEVELOPMENT OF WET AND DRY STRENGTHS OF PAPER. G. E. Gromm. Pulp Paper Mag. Can. *46*, No. 3, 157–60, 164 (1945). Treatment of paper with small amounts of melamine-formaldehyde resins increases the wet and dry tensile strengths, wet and dry bursting strengths, folding endurance, and wet and dry rub resistances. The absorbency of unsized paper is not affected.

APPLICATION OF PLASTICS TO PEACETIME USAGES. R. P. Dinsmore. India Rubber World *113*, 395–7 (Dec. 1945). Peacetime uses of plastics in packaging, adhesives, insulation and lacquers are reviewed.

PACKAGING APPLICATIONS OF NON-WOVEN TEXTILES. Modern Packaging *19*, 100–5 (Feb. 1946). Nonwoven textiles are made by bonding cellulose fibers together with thermoplastics. The cost approaches that of paper. These materials are used for the most part for packaging.

DESIGNING WITH ACRYLICS. D. A. Rothrock. Modern Packaging *19*, 112–15 (Feb. 1946). The designing of display fixtures made with acrylic plastics is discussed. The crystal clarity, lighting qualities and workability of these plastics make them exceptional materials for fabricating display fixtures and novelty packages.

Coatings

DRYING-OIL POLYMERIZATION SINCE 1930. E. Sunderland. J. Oil Colour Chem. Assoc. *28*, 137–67 (1945). The work on drying oil polymerization published since 1936 is critically reviewed.

COATINGS FOR PLASTICS. Am. Paint J. *30*, No. 6A, 18 (1945). Coatings for plastics are discussed. Those based on the vinyl chloride acetate copolymers and the vinyl butyrals have the best adhesion to plastics. The phenolics have the poorest adhesion.

NOTES ON THE DEVELOPMENT OF PROTECTIVE COATINGS IN GERMANY. W. E. Gloor. Am. Paint J. *30*, No. 12, pp. 95, 98, 100, 102, 104, 106 (1945). The resins, plasticizers and pigments used in the formulation of German protective coatings are described.

RESIN BAKING COATINGS BY INDUCTION HEATING. R. J. Moore. Am. Paint J. *30*, No. 6B, pp. 5, 20–25 (1945). The properties and uses of coatings based on phenolic resins are described. Induction heating to cure or bake these coatings is discussed.

NEW SOLVENTS AND PLASTICIZERS FOR SURFACE COATINGS. W. A. Woodcock. Am. Paint J. *30*, No. 6B, 10–12 (1945). The function and use of plasticizers and solvents for coating materials are discussed.

SURFACE FILMS OF POLYMERS. I. FILMS OF THE FLUID TYPE. D. J. Crisp. J. Colloid Sci. *1*, 49–70 (Jan. 1946). Many linear polymers containing water-attracting groups, such as polyesters, polyethers, polyalcohols and polyacids, may be spread uniformly at the air-water and oil-water interface. Polymers with the least internal cohesion spread most easily, those with high internal cohesion do not spread well. The character of the resulting film depends on the balance between the lateral attractions at the surface and the water-attracting properties of the polar groups. The specific area occupied per monomer unit is independent of the molecular weight in high polymers. Fluid films gelating only at high surface pressure are termed "fluid amorphous type." They exhibit a low pressure region in which there is free space between the chains, a high pressure region where an increasing proportion of the groups are formed into an "overfilm," and a collapse pressure or pressure range where the "overfilm" is complete and has properties of the bulk polymer. Segments in the overfilm are in equilibrium with segments in the monolayer, the process being reversible. Certain films appear to have a small proportion of residues distributed into an "over-film" at zero pressure. Estimations of the limiting area are in reasonable agreement with known intermolecular dimensions and probable molecular configurations. The values of apparent surface moments are comparable to those in long chain films, and the dipoles are, in the majority of vinyl derivatives, free to orientate fully.

SURFACE FILMS OF POLYMERS. II. FILMS OF COHERENT, SEMI-CRYSTALLINE TYPE. D. J. Crisp. J. Colloid Sci. *1*, 161–84 (March 1946). Polymer films which possess strong intermolecular forces are only slightly expanded and not very stable. When strongly hydrophilic groups are present, but the lattice forces are high, stable films exist only at surface pressures of a few dynes/cm. Without strongly hydrophilic groups the films tend to collapse spontaneously. A series of polymethacrylate films illustrate the effect of the side chain on the film character. Short side chains result in strong intermolecular forces and coherent films; flexible side chains reduce these forces, giving a more expanded type, while large side chains introduce secondary cohesion. High viscosity and intermolecular cohesion will account both for hysteresis and collapse phenomena in such films. At the oil-water interface the intermolecular forces parallel to the surface are greatly reduced, and the differences between coherent and fluid films become less pronounced. The low resolved surface dipole moment of polyvinyl alcohol and polyacrylic acid is attributed to hydrogen bonding. The effect of ionization of films of polyacids on their surface properties is described, solution of the film taking place when a sufficient proportion of residues become charged. Polyamides form very coherent films due to bonding of the peptide link, and the bearing of this on the structure of protein films is discussed. Evidence is provided that films of proteins as well as other polymeric substances form a three-dimensional "overfilm" at the time that they collapse.

Technical Briefs

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

POSSIBLE METHODS FOR COMBINING SYNTHETIC RESINS WITH PAPER DIRECTLY ON THE PAPER MACHINE. R. H. Mosher. Paper Trade J. *121*, 47–9 (Dec. 20, 1945). Synthetic resins are used with paper to produce a variety of products such as laminating and special packaging papers. Although usually applied in a separate operation it is possible to apply resins to the sheet on the paper machine. The resins are added at the beater, stock chest or headbox, in the section between wire and drives, or in the driers by means of a coating unit or size press. The various methods and the resins are discussed.

CELLULAR PLASTICS IN AIRCRAFT. C. C. Sachs. Mechanical Eng. *68*, 233–6 (March 1946). MODERN PLASTICS 23, 173–6 (Dec. 1946). Every class of synthetic-resin polymer has been converted into cellular form. Most of the cellular boards are available only from pilot-plant operations at present. Plastic cellular boards possess very low specific gravity and excellent heat- and sound-insulating qualities, in addition to having physical properties comparable to balsa wood. The chemical properties and uniformity obtainable should enable this form of plastic material to be used to good advantage in many airplane structural applications. The possibility of utilizing cellular boards as core material for structural sandwich construction should mean saving of weight and fabrication simplicity.

EFFECT OF HIGH HUMIDITY AND FUNGI ON THE INSULATION RESISTANCE OF PLASTICS. J. Leutritz, Jr., and D. B. Herrmann. A.S.T.M. Bull. No. *138*, 25–32 (Jan. 1946). The decrease in insulation resistance of methyl methacrylate, glass-bonded mica phenolic, glass mat laminated phenolic, fabric laminated phenolic, fiber-filled phenolic and woodflour-filled phenolic plastics was determined during prolonged exposure of the plastics to fungi and 97 percent relative humidity at 25° C. The same plastics with fungi present also were exposed to 87, 76 and 52 percent relative humidity to study their recovery, and then re-exposed to 97 percent relative humidity. Specimens with cleaned surfaces and with varnished surfaces were dried and then exposed to fungi and high humidity. The insulation resistance of a fungous network on methyl methacrylate plastic was determined at 87, 76 and 52 percent relative humidity. Fungous growth occurred on all test specimens except those with cleaned or varnished surfaces. The decrease in insulation resistance was retarded by the varnish. The degradation is due entirely to moisture. The rate of recovery is dependent on the composition and structure of the materials. None of the plastics is permanently affected by exposure to fungi and high humidity. Cleaning of surfaces and removal of moisture restored the insulation resistance to its original high value in every case. Water sorption, not fungi, is the critical factor in the deterioration of the insulation resistance of these plastics.

PURIFICATION OF WATER BY USE OF SYNTHETIC ION-EXCHANGE RESINS USING pH AS A CONTROL. A. L. Kenworthy and J. N. Howard. Soil Science *57*, 293–4 (Apr. 1944). It is shown that an ordinary pH meter can be used to detect the breakthrough point when synthetic ion-exchange resins are used to purify water. The meter may also be used to regulate the regeneration and washing process.

Chemistry

EFFECT OF POLYMER CHAIN LENGTH ON THE SOLUBILITY AND SWELLING OF POLYTHENE. R. B. Richards. Trans. Faraday Soc. *42*, 10–20 (Jan.–Feb. 1946). The phase equilibria between organic liquid and polythene, a typical crystalline polymer, are discussed. Poor solvents such as nitrobenzene are incompletely miscible with liquid polythene. A plot against composition of the minimum temperature at which a single liquid phase is stable shows a maximum. Good solvents such as xylene do not show such a maximum, the solubility curve representing the depression of the melting point of the polythene crystallites by the solvent. Solid (i.e., semi-crystalline) polythene absorbs and reaches equilibrium with liquids; the amount of absorption increases with rise in temperature but is less than would be expected for a completely amorphous material. Precipitation of solid polythene on cooling a solution leads to a fractionation, the high molecular weight species being precipitated first. High molecular weight polythenes are less soluble and absorb less liquid than low molecular weight polythenes; when the solvent is not completely miscible with liquid polythene, the critical composition occurs at a lower polythene concentration. The results are qualitatively in agreement with theoretical work by Flory, Gee and Huggins. Of samples of polythene of the same average molecular weight, those which contain the higher proportion of short chain material are the more soluble and swell more in organic liquids.

PREPARATION, PURIFICATION AND POLYMERIZATION OF DIETHYL SILICON DICHLORIDE. T. Alfrey, F. J. Honn and H. Mark. J. Polymer Sci. *1*, 102–120 (March 1946). Diethyl silicon dichloride was prepared by a Grignard synthesis and purified highly. The material in various stages of purification was hydrolyzed and then polymerized. The properties of the hydrolyzate and of the final polymer depended markedly upon the degree of purification of the dichloride. The reaction of diethylsiliconediol with phosphorous pentoxide was also studied; the predominating reaction appears to involve entrance of the pentoxide into the polymeric structure, rather than a simple acceleration of the polycondensation reaction by the removal of water. A survey of the literature on the silanes and silicones serves as an appendix to the article.

EFFECT OF SOLVENT TYPE ON THE SOLUBILITY AND SWELLING OF POLYTHENE. R. B. Richards. Trans. Faraday Soc. *42*, 20–8 (Jan.–Feb. 1946). Data are given comparing the solubility of polythene in a number of organic liquids of different types and the amount of the liquids absorbed by solid polythene. The best solvents, i.e., those liquids which dissolve a given quantity of polythene at the lowest temperatures, are absorbed to the greatest extent by solid polythene. Polythene being mainly crystalline at ordinary temperature, absorbs of the order of one-tenth the amount of liquids absorbed by raw or lightly vulcanized rubber. Hydrocarbons and halogenated hydrocarbons are the best solvents and are absorbed to the greatest extent. The amount of absorption decreases with increase in the heat of mixing, as indicated by the differences between the cohesive energy densities of polythene and the liquid. The relations obtained are similar to those found by Gee for rubber. Gee's treatment of absorption was concerned primarily with differences in heats of mixing. Some solubility and absorption phenomena in polythene systems which

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Bulletin 4405 depicts the construction and design features of the H-P-M 350-H-16 (16 ounce capacity) injection molding machine. Complete engineering specifications including sectional die drawings of the straight-line hydraulic mold clamp, injection chamber and feed unit are included.

Bulletin 4601 describes the new revolutionary Turbojector for injection molding of rubber. One section of the bulletin is devoted to the design and operating features of this machine. Molded parts made with the H-P-M Turbojector are illustrated, and complete production data concerning these parts is included.

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indicate changes in entropies of mixing are discussed: for example, systems involving strongly polar or high molecular weight liquids. Rate of swelling and solution, and effect of absorbed liquids on mechanical properties are considered.

CHAIN INITIATION IN CATALYZED POLYMERIZATION. M. M. Matheson. J. Chem. Phys. *13*, 584–5 (Dec. 1945). A mechanism for chain initiation in polymerizations catalyzed by peroxides is outlined. The mechanism yields the polymerization rate equation of Schulz and Mark, agrees with first-order decomposition of benzoyl peroxide in benzene, explains higher decomposition rate in monomer in fashion suggested by Price.

Properties

WATER-RESISTANT FILMS OF PLASTIC MATERIALS. P. D. Ritchie and I. W. A. Kirkwood. Engineering Materials *3*, 51–3 (April 1945). Water-resistant plastic materials utilized for packaging may be applied by 1) dipping or spraying 2) wrapping with film and 3) wrapping with films which are reinforced or laminated with fabric or paper. Permeability values for plastic films are reported.

DIELECTRIC PROPERTIES OF HOMOGENEOUS MATERIALS AT HIGH ELECTRIC STRESS. A. E. W. Austen. J. Inst. Elec. Engrs. (London) *92*, I, 373–7 (1945). Measurements with mica, polystyrene and phenol-formaldehyde resin at 50 cycles per sec. up to 10 million v. per cm., about one-fifth the intrinsic electrical strengths, show that the change of phase angle does not exceed 0.0005. An increase in capacitance of 0.0025 was observed for the phenolic resin.

SILICONE INSULATION PROVED BY TEST. T. A. Kauppi, G. Grant, G. L. Moses and R. F. Horrell. Westinghouse Engr. *5*, 135–40 (1945). The silicone resins are satisfactory as insulation materials for electrical motors. They are outstanding in thermal endurance and moisture resistance. The results of severe accelerated aging tests are reported.

CHARACTERIZATION OF CELLULOSE DERIVATIVES BY SOLUTION PROPERTIES: PLASTICIZERS AS SOLVENTS. H. M. Spurlin, A. F. Martin and H. G. Tennent. J. Polymer Sci. *1*, 63–74 (March 1946). The dimensional stability of molded thermoplastic articles is a function of the extent to which stresses are frozen into them on molding. The kind and amount of plasticizer included in the material to be molded may be varied to minimize the amount of these stresses. Methods of obtaining fundamental information about polymer-plasticizer systems from simple measurements of viscosity and osmotic pressure are suggested, and some results for cellulose derivatives are given.

Testing

X-RAY EXAMINATION OF LAMINATED PLASTICS. H. Barker. Machinery (London) pp. 677–80 (June 21, 1945). The use of X-ray equipment for examining articles made of paper-laminated phenolic plastics is described. The procedure is used for control inspection of high-voltage parts to find structural flaws.

A RAPID PHOTO-ELECTRIC OPTICAL DISTORTION TESTER FOR PLASTIC WINDOWS. J. M. Sowerby and W. H. Walton. J. Sci. Instruments *22*, 71–4 (April 1945). A photoelectric optical distortion instrument suitable for testing small molded transparent plastic objects is described.

DETERMINATION OF MOISTURE IN PLASTIC MOLDING POWDERS BY THE KARL FISCHER PROCESS. G. R. Cornish. Plastics (London) *10*, 99–103 (Feb. 1946). The Karl Fischer method was successfully used for the determination of moisture in plastic molding powders. The precision of the method is of the order of 0.5 percent of the moisture present. In the absence of really reliable alternative methods it was not possible to assess the accuracy, but it is a quite reliable standard control test.

KNOOP INDENTER AS APPLIED TO TESTING NONMETALLIC MATERIALS RANGING FROM PLASTICS TO DIAMONDS. V. E. Lysaght. A.S.T.M. Bull. No. *138*, 39–44 (Jan. 1946). The Knoop indentation hardness tester is described. The use of this instrument for measuring the hardness of minerals, abrasives, plastics, dentine, enamel and glasses is discussed.

DETERMINATION OF PHTHALIC ANHYDRIDE. P. L. Gordon and I. Lerner. Am. Paint J. *30*, No. 9, 51, 54 (1945). A time-saving modification of the Kappelmeier method for determining the phthalic anhydride content of alkyd resin is described. It involves saponification of the resin with potassium hydroxide in isopropyl alcohol and the gravimetric determination of the potassium phthalate precipitate.

Synthetic Rubber

OXIDATION OF GR-S VULCANIZATES. J. R. Shelton and H. Winn. Ind. Eng. Chem. *38*, 71–6 (Jan. 1946). The effect of surface area, cure and temperature on the rate of oxygen absorption by a tread type GR-S vulcanizate was measured by a volumetric method at substantially constant pressure, and changes in physical properties were correlated with oxygen absorption. Under the conditions employed, chemical reaction and not diffusion is the rate controlling factor. Three stages are involved in the oxidation: an initial rapid reaction of apparent first order, involving a limited number of "active" centers, which is completed within a few hours at 100° C.; a slower constant-rate reaction of apparent zero order, which accounts for most of the degradation of properties normally encountered in service; and an autocatalytic reaction starting after the absorption of approximately 5 percent of oxygen based on GR-S in the vulcanizate, which rapidly converts the sample into a hard brittle condition. The use of oxygen absorption methods offers certain advantages over the usual physical property methods for evaluating the effect of compounding ingredients upon aging resistance.

REACTION OF ORGANOSODIUM COMPOUNDS WITH BUTADIENE. A. A. Morton, G. H. Patterson, J. J. Donovan and E. L. Little. J. Am. Chem. Soc. *68*, 93–6 (Jan. 1946). Under the conditions tried butadiene adds with amyl-, benzyl- and cyclohexyl-sodium. The sodium compounds are decomposed by carbon dioxide or by water and alcohol to give acids or hydrocarbons. The acids and derived esters having saponification equivalents and double bonds which correspond to addition of one or two butadiene units can be isolated readily. Those which have three or more units show unsaturation lower than expected and an oxygen content which is abnormally high. Other properties of the esters suggest that oxygen is absorbed readily. These compounds, whether as esters or the corresponding hydrocarbons, undergo thickening by a thermal polymerization at 230° F. The residues and rubber-like products undergo a similar thermal polymerization. Phenylsodium, furylsodium and *p*-phenylphenylsodium do not add readily to butadiene. Rubber-like products are formed by these reagents.

NEOPRENE IN PRODUCT DESIGN. V. A. Cosler. Product Eng. *17*, 61–4 (Jan. 1946). The properties and uses of neoprene are discussed. Some of the uses of neoprene include gas masks, life belts, life rafts, pontoons, protective clothing, wire and cable jackets, gloves, balloons, carburetor diaphragms, delousing bags, helmet liners, hose and tubing, molded parts for planes, tanks, trucks, busses and motor cars, oil seals, belts, gaskets and flexible couplings.

DENSITIES OF GR-S LATICES. C. C. Winding. Ind. Eng. Chem. *37*, 1203–6 (Dec. 1945). A densitometer capable of indicating densities of unvented GR-S latices with an absolute accuracy of approximately 0.002 gm. per cc. was developed. The design permits the instrument to operate over a wide range of pressures without affecting its accuracy. The present instruments were constructed to withstand pressures of 100 to 150 p.s.i., but this range can be extended. Complete data were obtained on samples of stripped and unvented GR-S latices.

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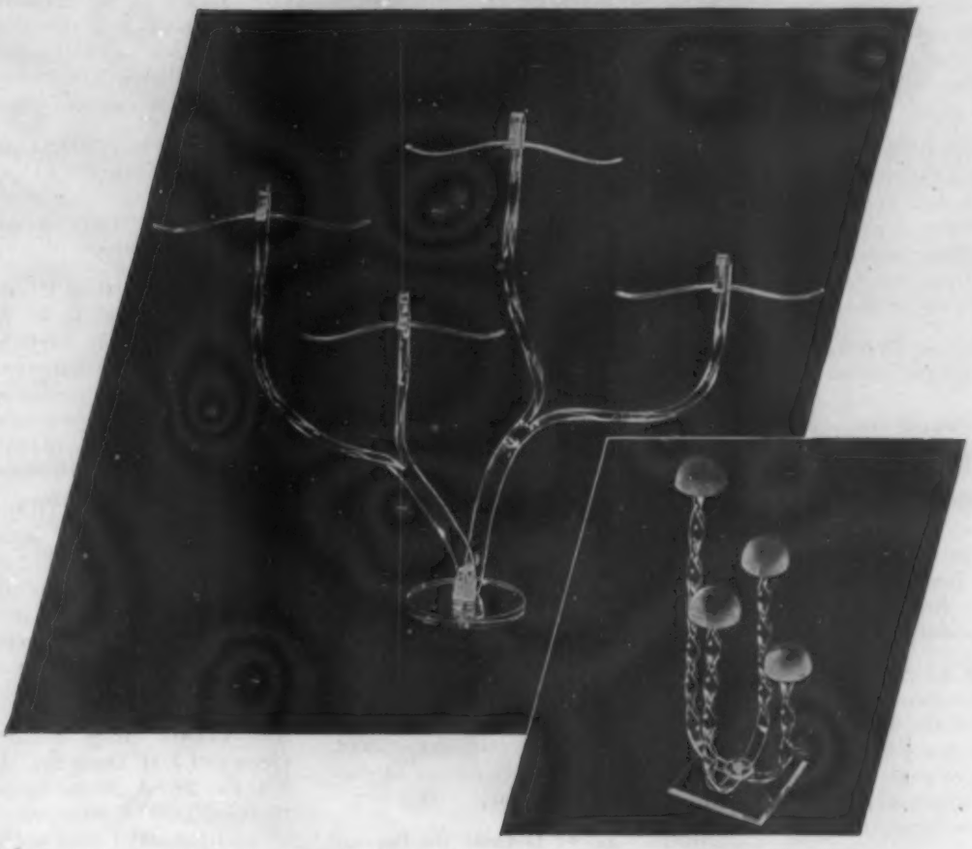

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CONTAINERS. K. Stuart and A. B. Wilson (to E. R. B. Stuart). U. S. 2,393,347, Jan. 22. A tubular container is made by forming a spirally wound tubular container body having an integral continuous lining of thermoplastic material, providing a closure member continuously lined with the thermoplastic material, and applying heat and pressure to fuse linings into an integral structure.

BUILDING ELEMENT. W. R. Jones (to Celotex Co.). U. S. 2,393,379, Jan. 22. A building element comprising a preformed strip of fiber reinforced plastic deformable upon slight heating, and separate independent strips of surface waterproofed fiber board adherent to a face of base sheet.

PLASTIC. Z. T. Walter. U. S. 2,393,437, Jan. 22. A monolithic, laminated, molded plastic prepared by impregnating sheets of porous fabric with a solution of cellulose derivative, stretching one sheet over a matrix formed to shape a surface of the product, successively superposing thereon additional sheets, applying a coating of solution to, and individually curing, each sheet until the impregnating and coating material passes from the wet to dry state before superposing next sheet.

COPOLYMERS. S. M. Weisberg, E. G. Stimpson and J. Greenspan (to Sealtest, Inc.). U. S. 2,393,438, Jan. 22. A polymer product is prepared by copolymerizing an alkyl ester of acrylic acid and isoprene in an aqueous emulsion containing a caseinate and a peroxide catalyst.

DECORATIVE ELEMENTS. M. H. Storch. U. S. 2,393,486, Jan. 22. A decorative article is prepared by molding a plastic element having a marginal flange in which are aligned holes and adjacent tabs, placing a tape or cord in the holes, and applying heat and pressure only to the tabs so as to soften and bend the flange.

REINFORCED TUBING. T. W. Stedman (to Firestone Tire & Rubber Co.). U. S. 2,393,496, Jan. 22. Reinforced tubing comprising an inner flexible, tubular structure of rubber and an outer sheath composed of monofilaments of a plasticized vinylidene chloride copolymer.

POLYVINYL CHLORIDE. F. A. Bent and K. E. Marple (to Shell Development Co.). U. S. 2,393,512, Jan. 22. A homogeneous composition of polyvinyl chloride and glycerol di(cresylic acid) ether.

POLYVINYL ACETAL. F. A. Bent and K. E. Marple (to Shell Development Co.). U. S. 2,393,513, Jan. 22. A composition comprising a polyvinyl acetal resin and a diglycerol trialkyl ether.

CELLULOSIC SHEET. D. M. Musser and H. C. Engel (to National Cotton Council of America). U. S. 2,393,553, Jan. 22. Sheets of felted, fibrous, cellulosic materials are prepared by beating in an aqueous solution containing methyl cellulose.

PRINTING INKS. W. L. Jones and E. De Lia (to Interchemical Corp.). U. S. 2,393,637, Jan. 29. An intaglio printing ink consisting of a pigment dispersed in a vehicle consisting of a solvent, a rosin modified phenol aldehyde resin and ethyl cellulose.

STENCIL SHEET. A. J. Wartha (to Minnesota Mining & Manufacturing Co.). U. S. 2,393,668, Jan. 29. A stencil for use in conjunction with sandblasting comprising on abrasive resistant sheet formed of rubber, a coating of pressure sensitive adhesive on one side, and a backing layer of glue, ethyl cellulose or shellac.

RECOVERY PROCESS. G. W. Seymour and G. C. Ward (to Celanese Corp. of America). U. S. 2,393,712, Jan. 29. Wool is recovered from mixtures with cellulose acetate by immersing in an aqueous bath containing ethyl alcohol, sulfuric acid, and hydrochloric acid, drying, and baking at elevated temperatures to carbonize the cellulose acetate.

RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,393,752, Jan. 29. The reaction product of dimethylol urea and a halogenated acetamide.

CURING AGENT. G. F. D'Alelio and J. W. Underwood (to General Electric Co.). U. S. 2,393,753, Jan. 29. A curing agent, capable of accelerating the curing of an acid-curing thermosetting resin, comprising the soluble, fusible reaction product of an aldehyde and a diazinyl carboxy-alkyl sulfide.

CELLULOSE ESTERS. D. J. Kridel (to Eastman Kodak Co.). U. S. 2,393,783, Jan. 29. Wood pulp board is converted to a form suitable for esterification by subjecting, while containing 60 percent water, to compressed air to blow apart the pulp fibers and then drying.

CELLULOSE ESTERS. L. W. A. Meyer and W. M. Gearhart (to Eastman Kodak Co.). U. S. 2,393,794, Jan. 29. A cellulose organic ester plastic containing a plasticizer and resacetophenone as a stabilizer against ultraviolet light.

CELLULOSE ESTERS. D. R. Morey and R. L. Tichenor (to Eastman Kodak Co.). U. S. 2,393,801-2, Jan. 29. A cellulose organic acid ester plastic containing a plasticizer and a 3-alkyl-2-phenylimino benzothiazoline or N,N'-diphenyl acetamidine as stabilizer against ultraviolet light.

ANTISTATIC COATING. C. S. Myers (to Bakelite Corp.). U. S. 2,393,863, Jan. 29. A surface of a vinyl resin having applied thereto an antistatic film of polyethylene glycol.

RUBBER HYDROCHLORIDE. H. F. Reeves, Jr., and T. M. Andrews (to Bay Chemical Co., Inc.). U. S. 2,393,870, Jan. 29. Rubber is converted to rubber hydrochloride by contacting with gaseous hydrogen chloride in the presence of a penetrant in vapor phase, said penetrant being a solvent for rubber and hydrogen chloride.

RUBBER HYDROCHLORIDE. H. F. Reeves, Jr., and T. M. Andrews (to Bay Chemical Co., Inc.). U. S. 2,393,871, Jan. 29. Vulcanized rubber hydrohalide is prepared by reacting vulcanized rubber with gaseous hydrohalide in presence of a gaseous penetrant form which will swell the rubber.

COATING. F. E. Trent (to W. F. Geyer and J. H. Donnelly). U. S. 2,393,874, Jan. 29. A coating comprising a water-in-oil type of emulsion of a drying oil modified alkyd resin and granular exfoliated micaceous material.

RESIN. W. A. King, J. Kleiner and J. R. Clark (to Allied Chemical & Dye Corp.). U. S. 2,393,912, Jan. 29. A crude aromatic hydrocarbon oil containing gum-forming constituents is treated with sulfuric acid to polymerize the gum-forming portion, the acid is neutralized, the mass is heated to distill off volatile material as a refined solvent and the residue is extracted to remove inorganic constituents and separate a resinous fraction.

CABLE JOINT. T. R. Scott (to Federal Telephone & Radio Corp.). U. S. 2,393,935, Jan. 29. A cable joint comprising a paper-insulated cable joined to a rubber insulated cable, a fibrous tape impregnated with a mixture of rubber and polystyrene wrapped around connected cables and the paper and rubber insulation.

SURFACING. M. R. Ximinez (to Johns-Manville Corp.). U. S. 2,393,947,

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Jan. 29. A sheet material comprising plies of asbestos paper impregnated with heat and pressure cured phenolic resin containing tricresyl phosphate.

TETRAFLUOROETHYLENE. M. M. Brubaker (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,393,967, Feb. 5. Tetrafluoroethylene is polymerized by contacting with water at 0 to 200° C. under one atm. of pressure.

POLYAMIDES. T. L. Cairns (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,393,972, Feb. 5. An infusible insoluble shaped article is prepared from polyamides by reacting a mixture yielding a liquid which gels on standing, the mixture consisting of formaldehyde and a solution of a linear polyamide in an oxygen-containing organic acid, continuing the reaction until a substantial number of amido hydrogen groups have reacted with formaldehyde, shaping, removing solvent, and heating until infusible.

COMPOSITE MATERIAL. J. Harmon (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,393,987, Feb. 5. An article comprising a waterproofed paper surface and a member adhesively bonded to said surface with a film of diisocyanate-treated synthetic linear polyester-amide.

RESIN. T. R. McElhinney (to W. J. Gibbens, Jr.). U. S. 2,394,000, Feb. 5. A resin of the phenol-formaldehyde type is prepared by liberating aldehydes and ketones from ligno-cellulosic material with live steam in the presence of acid under pressure and reacting simultaneously with phenol.

CELLULOSIC FILMS. J. D. Pollard (to American Cyanamid Co.). U. S. 2,394,009, Feb. 5. Non-fibrous films of regenerated cellulose are impregnated with an acidic, aqueous, colloidal solution containing partially polymerized melamine-formaldehyde resin, washed with water, a plasticizer is introduced, the film is dried, and thereafter is applied a water-repellent coating composition.

RESINS. R. W. Quarles (to Carbide and Carbon Chemicals Corp.). U. S. 2,394,010, Feb. 5. A coating composition containing a chlorine-containing resin normally subject to deterioration on heating and, as an inhibitor of such deterioration, a ketone-soluble resinous ester of a dicarboxylic acid and an aryltertiary dialkylolamine having two to three carbon atoms in each alkylol radical.

COATINGS. H. C. Phillips and P. F. Robb (to Hercules Powder Co.). U. S. 2,394,101, Feb. 5. A protective coating for metal during storage comprising a hot-melt mixture of ethyl cellulose, a solvent plasticizer, a non-solvent plasticizer, and a thermoplastic resin.

CONTAINER CLOSURE. M. E. Baar. U. S. 2,394,135, Feb. 5. A molded plastic bottle cap having a plurality of spaced recesses containing inserts of plastic friction material impregnated with grit molded into the recesses.

TETRAFLUOROETHYLENE. R. M. Joyce, Jr. (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,394,243, Feb. 5. Tetrafluoroethylene is polymerized by heating at 55 to 240° C. at a pressure of 1000 lb./sq. in. in the presence of water and oxygen or a peroxy compound.

COATING. T. W. Noble. U. S. 2,394,254, Feb. 5. A flexible, non-tacky, slick, dry, thermoplastic coating consisting of stearic acid, ethyl cellulose, and paraffin wax.

DEFIBERING OF PAPER. W. M. Thomas (to American Cyanamid Co.). U. S. 2,394,273, Feb. 5. Paper impregnated with a cured melamine-, urea- or thiourea-formaldehyde resin is defibered by heating in acidified aqueous solution so as to hydrolyze resin but not cellulose.

ADHESIVE. M. E. Gross (to B. F. Goodrich Co.). U. S. 2,394,375, Feb. 5. An adhesive is prepared by condensing a phenol with furfural to form a fusible resin, dissolving in a solvent, further condensing in the presence of an acid condensation catalyst and adding to the solution an elastic vulcanizable rubbery material such as a natural or synthetic rubber.

ARTIFICIAL EYES. S. O. Noles, 2,394,400, Feb. 5. Artificial eyes are prepared by forming a blank of white plastic material having a convex front side, partially curing the blank, forming a cylindrical recess, inserting a colored wafer, covering with white uncured resin, remolding to original size, curing the plastic, forming a concave convex covering of transparent plastic over wafer and blank and curing.

POLYOLEFINS. F. J. Soday (to United Gas Improvement Co.). U. S. 2,394,407, Feb. 5. Aromatic olefins are polymerized by radiant infrared heat.

PLASTIC. V. Yngve (to Bakelite Corp.). U. S. 2,394,417, Feb. 5. Odor-stabilized plastic composition comprising a vinyl chloride-acetate copolymer resin, an ester plasticizer, and phthalic anhydride as odor stabilizer.

COLOR INHIBITOR. W. M. Quattlebaum, Jr., and C. A. Noffsinger (to Carbide and Carbon Chemicals Corp.). U. S. 2,394,418, Feb. 5. Coloration caused by partial decomposition by heat of polymeric vinyl resins is inhibited by mixing, after polymerization, with a color-reducing compound such as an α,β-olefinic unsaturated carboxylic acid or an anhydride and thereafter heating whereby the color is reduced.

CELLULOSE ESTERS. R. M. Goepp, Jr. (to Atlas Powder Co.). U. S. 2,394,439, Feb. 5. A plastic composition comprising a cellulose ester of a saturated straight-chain fatty acid and, as plasticizer, a hexide diester, the acyl radicals of which are 2 to 4 carbon atoms in length.

PRESSURE SENSITIVE MATERIAL. P. R. Gordon. U. S. 2,394,440, Feb. 5. A pressure sensitive adhesive is prepared by heat reacting equimolecular quantities of castor oil and maleic, aconitic, or itaconic acid to form a clear viscous oil, further heat reacting in an inert diluent in the presence of acetyl benzoyl peroxide with vinyl acetate to form a gel, adding more diluent to arrest the reaction, adding resin such as rosin, ester gum or coumarone-indene and grinding in a colloid mill.

WRINKLE FINISH. W. A. Waldie (to New Wrinkle, Inc.). U. S. 2,394,498–9–500, Feb. 5. Wrinkle finishes containing oil-modified alkyd and oil-modified phenolic resins.

CORE BINDER. H. A. Pace (to Wingfoot Corp.). U. S. 2,394,522, Feb. 5. A foundry core bound together with chlorinated rubber and chlorinated paraffin.

CELLULOSE DERIVATIVES. H. Dreyfus. U. S. 2,394,537, Feb. 12. The properties of cellulosic materials are improved by reacting with aliphatic hydrocarbon carbylamine of at least 4 carbon atoms.

ARTIFICIAL YARN. T. G. Finzel (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,394,540, Feb. 12. An untwisted yarn comprised of a plurality of synthetic thermoplastic filaments is spread so that the filaments are separated by passing the spread yarn over a heated rotating roll to render the yarns plastic while separated.

TEXTILE PRINTING. D. M. Gans (to Interchemical Corp.). U. S. 2,394,543, Feb. 12. A textile printing composition comprising an emulsion having an inner aqueous phase and an outer organic phase comprising pigment dispersed in a solution of polychloroprene in a volatile organic solvent.

ELECTRODE. C. D. Jensen. U. S. 2,394,550, Feb. 12. A tubular ferrous electrode for underwater cutting having applied thereto a coating of polyvinyl chloride containing an arc stabilizing material such as lime, talc, barium carbonate or iron oxide.

RESINS. F. P. Otto and O. M. Reiff (to Socony-Vacuum Oil Co., Inc.). U. S. 2,394,560, Feb. 12. A hard, light colored resinous material formed by reacting an aromatic compound in the presence of heat with a chlorinated petroleum wax in the presence of a Friedel-Crafts catalyst and adding metallic zinc and water to the product in order to decolorize the resin.

PHENOLIC COMPOSITION. O. M. Reiff and J. D. Zech (to Socony-Vacuum Oil Co., Inc.). U. S. 2,394,564, Feb. 12. A composition formed by heating chlorin-

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ated petroleum wax with a phenol having at least two reactive nuclear carbon atoms with a Friedel-Crafts catalyst, dechlorinating the product to cause unsaturation of the aliphatic groups and thereafter heating with sulfur to vulcanize.

TETRAFLUOROETHYLENE. A. F. Benning, F. B. Downing and J. D. Park (to Kinetic Chemicals, Inc.). U. S. 2,394,581, Feb. 12. A polymer of tetrafluoroethylene is heated in the presence of chlorine at a temperature of 630° C. and the reaction products are separated.

COATING. F. Knoth, Jr., and M. A. Pavlick (to Standard Oil Development Co.). U. S. 2,394,616, Feb. 12. An improved liquid coating comprising high molecular weight polymerizates of isomonoolefins and polyolefins, oleic acid, a petroleum wax, Dixie clay, triethanolamine and a petroleum sulfonate soap, all emulsified in water.

CONDENSER. J. N. Detrick (to Western Electric Co.). U. S. 2,394,670, Feb. 12. An electrical condenser comprising a pair of electrodes and a dielectric film between the electrodes comprising dielectric material in a binder of polyvinyl alcohol.

DYING. K. Heyman (to American Viscose Corp.). U. S. 2,394,689, Feb. 12. Yarns and other shaped articles comprising vinyl polymers are dyed by treating with an aqueous dye bath containing a suspension dyestuff in the presence of a water-insoluble, normally solid organic compound such as *o*-hydroxyacetophenone, benzopyhenone, methyl-*b*-naphthyl ketone camphor, benzalacetone and similar materials.

WOODEN SHOE SOLES. H. F. Loewer (to United Last Co.). U. S. 2,394,704, Feb. 12. A wooden shoe sole comprising a body layer and consisting of a plurality of strip-like wooden members, a tread layer and a hardened plastic securing the tread layer to the members.

LAMINATED STRUCTURES. E. L. Vidal and L. J. Marhoefer (to Vidal Research Corp.). U. S. 2,394,730, Feb. 12. An airfoil member is prepared by providing an interior mold, positioning adhesively treated reinforcing strips in grooves provided in the mold, superposing laminations of adhesively treated material on the mold exterior, subjecting to a molding process whereby the structure is bonded except on the trailing edge, removing the inner mold through the opening and finally adhesively bonding along the trailing edge.

POLYMERS. T. A. Ford (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,394,761, Feb. 12. A mixture of linear polymeric materials consisting of hydrocarbon chains having side groups of aromatic hydrocarbon radicals substituted by sulfonic acid groups and having two terminal monovalent radicals which together form a polyhalogenated methane.

TEXTILES. F B.. Hill (to British Celanese Ltd.). U. S. 2,394,772, Feb. 12. Textiles comprising aliphatic esters of cellulose are shrunk by applying a mixture of methylene chloride, ethylene dichloride.

POLYALCOHOL POLYMERS. W. A. Hoffman and C. W. Mortenson (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,394,776, Feb. 12. An ether of a polymeric polyhydric alcohol with a 3-hydroxythiolane-1-dioxide joined to the thiolane nucleus through an element selected from group V or VI of the Periodic Table.

COATED ARTICLE. F. J. Soday (to United Gas Improvement Co.). U. S. 2,394,816, Feb. 12. An article coated with a dried film of a benzene-soluble product of the hydrogenation of resinous polymerized cyclopentadiene, methyl cyclopentadiene or copolymers thereof in admixture with a vulcanizing agent.

DIOXOLANE POLYMERS. D. J. Loder and W. F. Gresham (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,394,862, Feb. 12. Polymers are prepared by polymerizing 1,3-dioxolane with an unsaturated compound such as unsaturated hydrocarbons, vinyl chloride or chloroprene in the presence of an acid catalyst.

DIOXOLANE POLYMERS. W. F. Gresham (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,394,910, Feb. 12. A 1,3-dioxolane-alkylene oxide interpolymer, the alkylene group containing less than 5 carbon atoms.

MOLDING APPARATUS. C. V. Smith (to Univis Lens Co.). U. S. 2,394,941, Feb. 12. An apparatus for simultaneously producing a plurality of forming operations on a plurality of blanks of resinous material.

POLYETHYLENE. H. S. Young (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,394,960, Feb. 12. Ethylene is inpolymerized with methyl methacrylate by charging a stainless steel reaction vessel with de-aerated water, methyl metahcrylate and benzoyl peroxide, adjusting mixture to a pH of 5.2 to 3.2 with formic acid, adding ethylene with 200 parts per million of oxygen, maintaining at 79 to 83° C. and 840 to 975 atmospheres in 18–8 stainless steel, and separating the polymer.

COATING. F. J. Soday (to United Gas Improvement Co.). U. S. 2,395,076, Feb. 19. A coating comprising drying oil and hydrocarbon resin polymer, such as a heat resin polymer or a catalytic resin polymer of polymerizable hydrocarbons.

REACTOR. W. J. Sparks and D. C. Field (to Jasco, Inc.). U. S. 2,395,079, Feb. 19. A polymerization reactor comprising, in combination, a reaction vessel, an agitator, a sealing cover, a packing gland, a tube passing through the sealing gland and having a spray means at the lower end, supply means for catalyst solution, a valved discharge outlet at the bottom of the vessel, a second packing gland in the cover, a rod passing through the gland and in coincidence with the discharge outlet, and a disk member on the end of the rod for clearing solids from the outlet.

OUTSOLES. J. A. Mahoney and W. S. Anderson (to Shoe Press Corp.). U. S. 2,395,133, Feb. 19. An improvement in cementing synthetic outsoles to shoes, comprising shoes with an outsole which have their corresponding attaching faces coated with a waterproof thermoplastic cement, submerging the cemented outsole in water at a temperature of 89 to 100° C. until the cement is activated, removing the outsole from the water and thereafter pressing the parts together to effect a permanent bend.

FUSE CONSTRUCTION. G. W. Wiard (to Virginia Electric Manufacturing Co.). U. S. 2,395,206, Feb. 19. An electrical fuse construction comprising a link unit consisting of spaced knife blades, a hollow molded casting of insulation material.

THERMOPLASTIC TAPE. A. T. Dildilian (to Bigelow-Sanford Carpet Co., Inc.). U. S. 2,395,257, Feb. 19. A thermoplastic tape adapted to overlap and secure the abutted edges of the backs of pile floor coverings. This comprises a thin flexible film consisting of a cellulosic compound nonviscid up to 400° F. united to the threads on one side of the tape and a thermoplastic adhesive coating comprising a vinyl resin.

DIOXOLANE POLYMERS. W. F. Gresham (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,265, Feb. 19. Polymers of 1,3-dioxolane are prepared by subjecting ethylene oxide to reaction with formaldehyde under substantially anhydrous conditions and in the presence of an acidic catalyst.

FILTER. E. C. Sloan (to Jesse B. Hawley). U. S. 2,395,301, Feb. 19. A filter member having a controlled degree of porosity is prepared by forming a water and fiber bath, adding a water-soluble synthetic resin, adding fine particles of inert material such as diatomaceous earth, vermiculate, kieselguhr or fuller's earth, mixing thoroughly, controlling porosity by amount of filler, forming a carcass onto a porous former, removing from the bath and drying the carcass.

POLYETHYLENE. W. E. Hanford (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,327, Feb. 19. Ethylene is polymerized in an aqueous medium by adjusting the pH in the range of 1 to 6 and carrying out the reaction at a temperature of 20 to 350° C. and a pressure which is above atmospheric in the presence of benzoyl peroxide.

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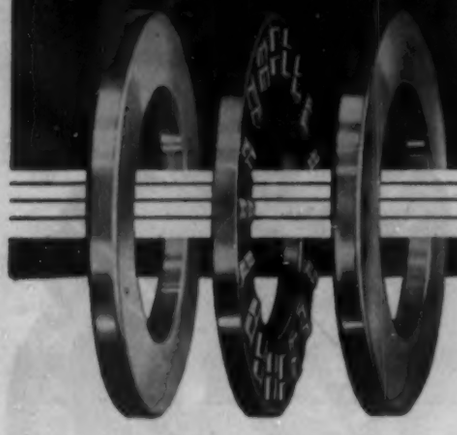

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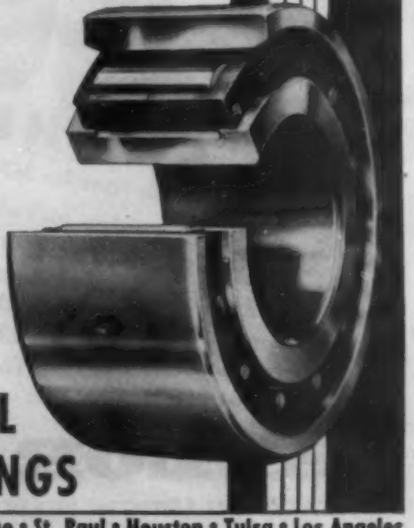

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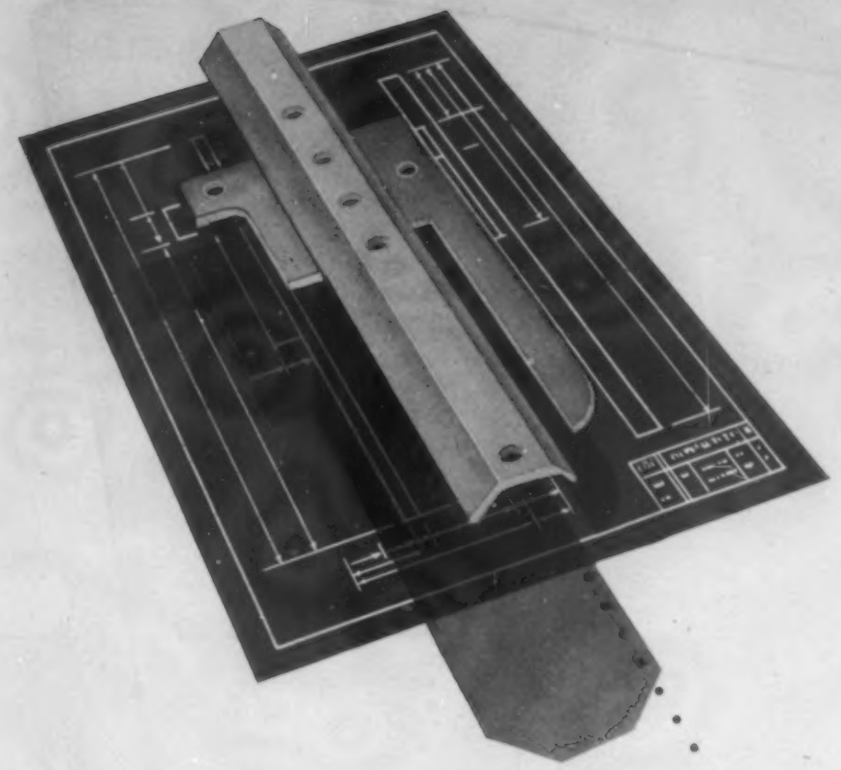

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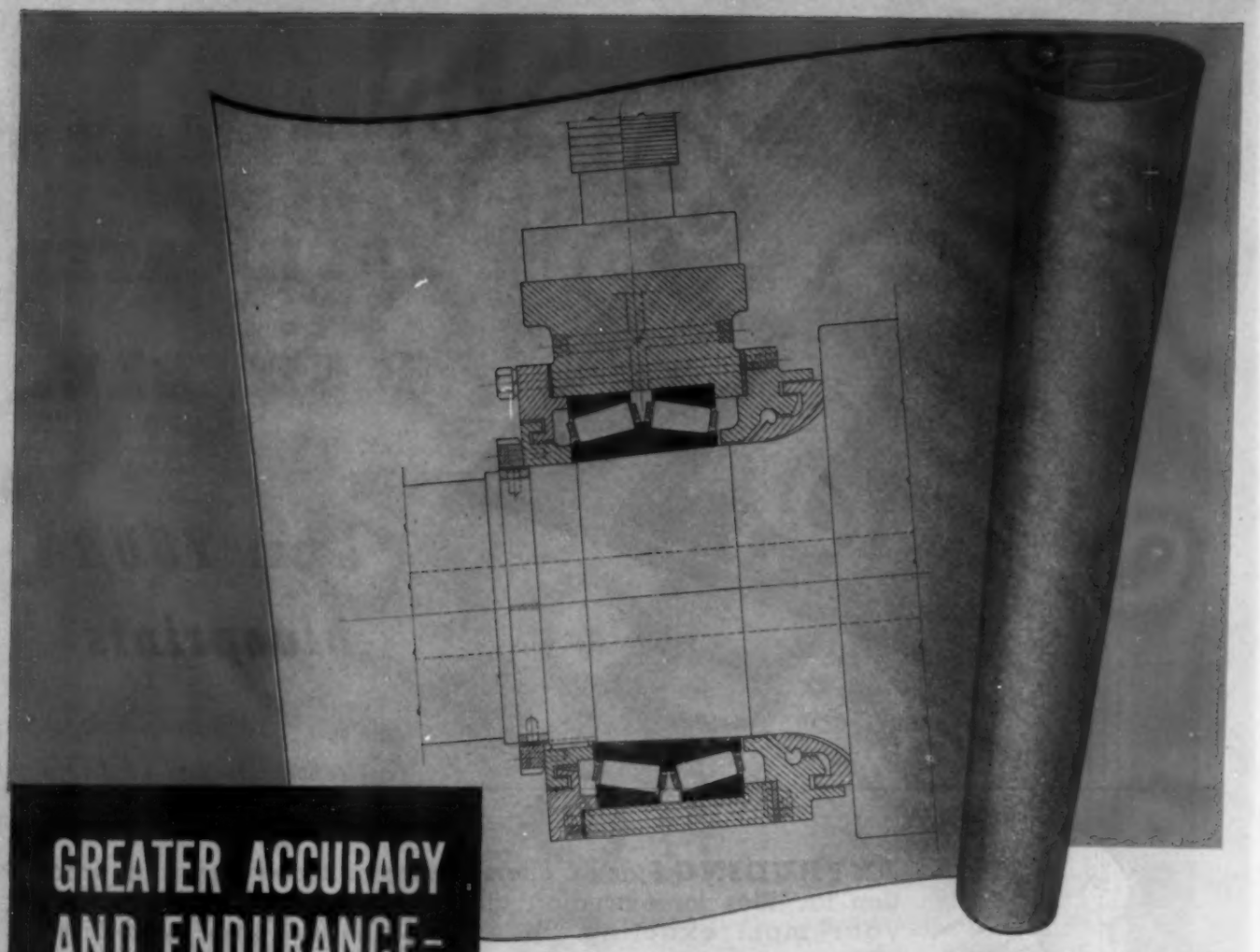

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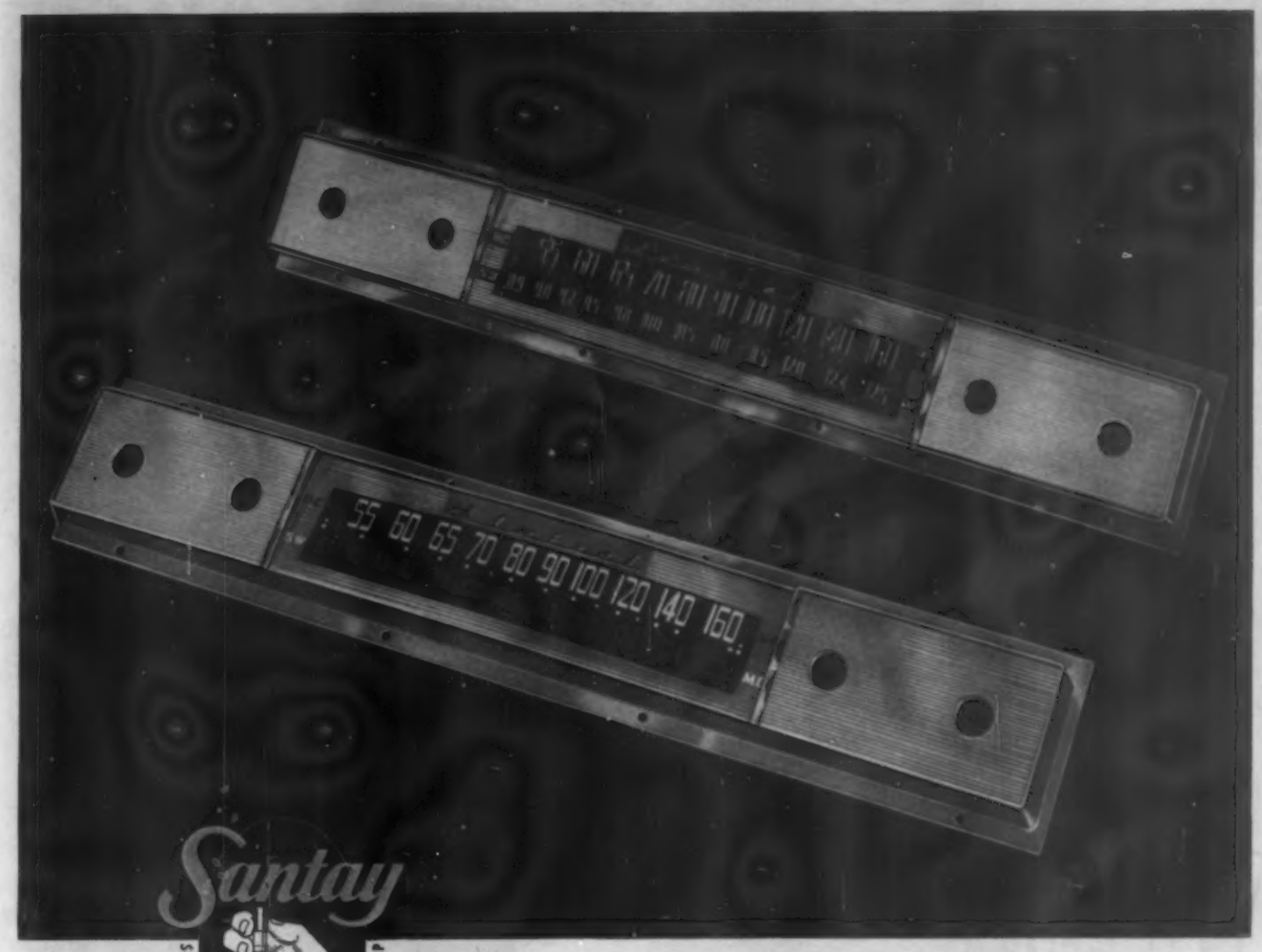

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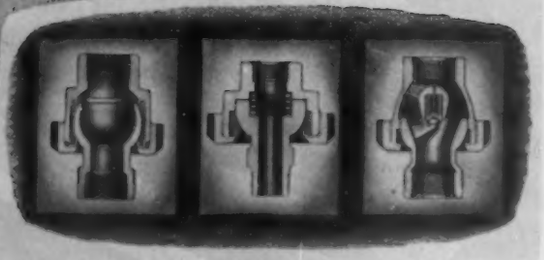

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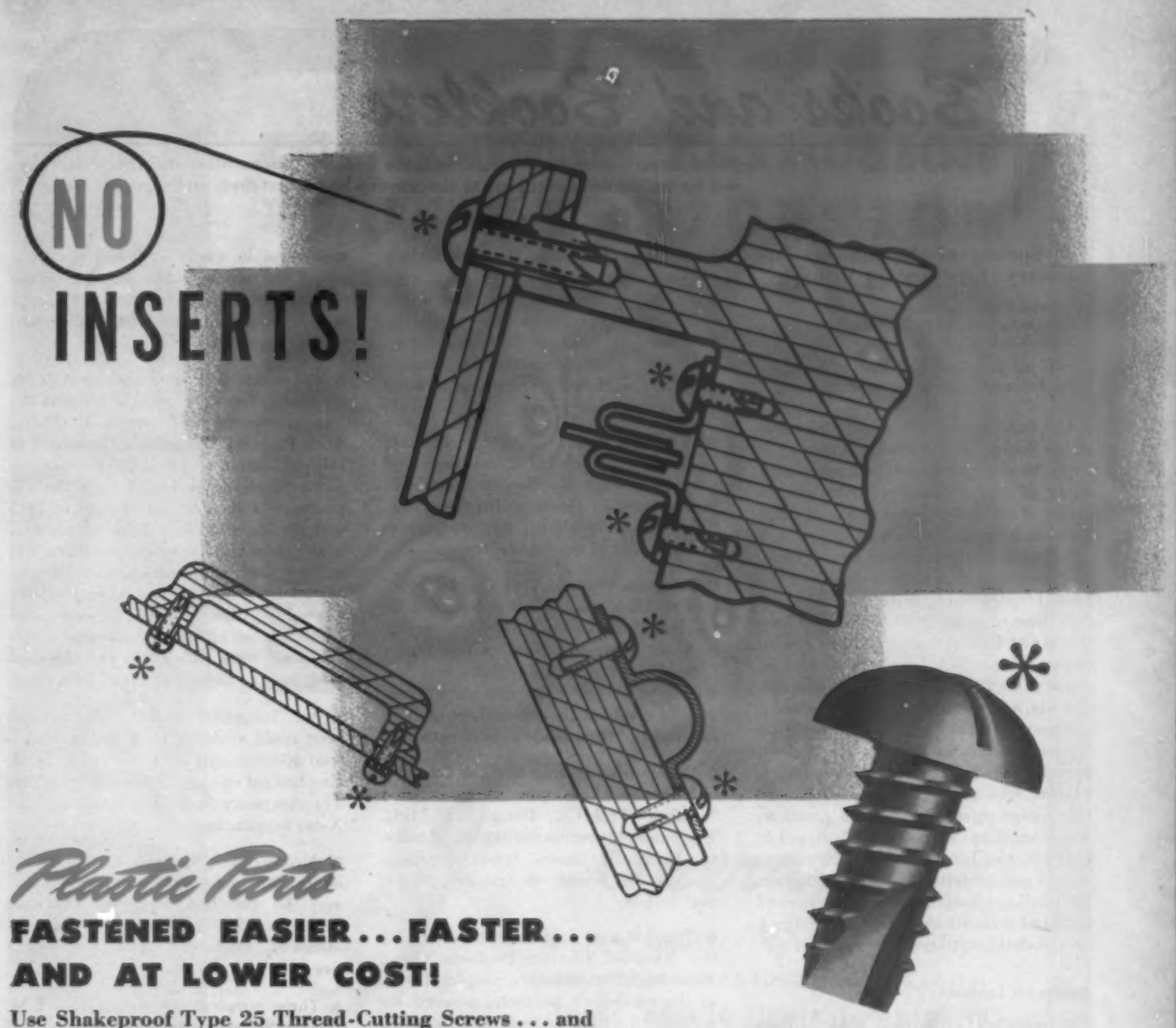

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Published by the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y., 1946

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Soap in industry

by Georgia Leffingwell and Milton Lesser

Published by Chemical Publishing Co. Inc., 234 King St., Brooklyn 31, N. Y., 1946

$4.00 **204 pages**

Intended as an indicative rather than an exhaustive survey of the industrial uses of soluble soaps, this book places its main emphasis on the growing place of such soap uses in industry. Chapter XIV is devoted to plastics and discusses emulsion polymerization in connection with the porous goods industries—textiles, leather, paper.

● Surface pyrometers are described in an illustrated bulletin (194-SA) just issued by Cambridge Instrument Company, Inc., New York 17, N. Y. Models including the roll, extension, mold, needle and surface types are shown and typical applications and standard ranges for each are given.

● American Phenolic Corp., Chicago 50, Ill., has published Vol. 1, No. 1, of a booklet known as "OK Methods," which is a correlation of work procedures based upon extensive experience in the manufacture and assembly of AN connectors. Adequate illustrations serve to show each step in the various operations. Covered in the handbook are methods for safety wiring, processing multiple conductors, ferrule crimping, soldering, processing beaded cable and others.

● Precision ground circular form tools for automatics, chucking machines and turret lathes are described in Bulletin F, just released by Hardinge Brothers, Inc., Elmira, N. Y. Included are specifications and drawings of the various tools.

● Tungsten Carbide Tool Co., Inc., Detroit 6, Mich., has issued a 4-page stock tool bulletin (No. FM-46) describing its new standard "Vibra-cushioned" carbide-tipped face mills designed especially for face milling of steels. The new cutters are said to combine the advantages of both inserted and fixed blade type of cutters.

● "Cone-drive gearing at work in materials handling" is now available from Michigan Tool Co., Detroit 12, Mich. Equipment covered in the illustrated bulletin includes: cranes, hoists, capstans, winches, lift trucks, electric shovels and coal cutters.

● This 350-page data book, published by the National Electric Products Corp., Pittsburgh, Pa., contains a complete listing of the company's products, grouped according to wiring systems and including every fitting, box or adapter.

Short informative chapters describe the various products and also outline that portion of the underwriters' laboratory standards, N.E.M.A., A.S.T.M. and federal specifications which is applicable to each particular item as it is discussed. Methods of installation are clearly illustrated.

● Davis Emergency Equipment Co., Inc., Newark 4, N. J., has released Technical Bulletin No. 1116 on the Combustible Gas Alarm System, a method for detecting and giving audible notification of hazardous gas or vapor conditions which may be present during industrial processing.

● Midget pumps and laboratory stirrers are the subject of a catalog published by Eastern Engineering Co., New Haven, Conn. Most of the pumps are available with either adjustable stuffing boxes or mechanical rotary seals.

● Industrial Review No. 4, publication of Industrial Tape Corp., New Brunswick, N. J., shows the many uses of industrial tape possible now that war restrictions are off and reconversion is on. Among the applications shown are identification, protection, insulation, masking, sealing and binding tapes.

● The second and final supplement to the abstracts of vested chemical patents has been announced by James E. Markham, Alien Property Custodian. Contained in this publication are about 800 patents and patent applications vested since the appearance of the first supplement in 1945 and dealing with such fields as plastics, heavy chemicals, ceramics, petroleum and drugs. Both supplements may be purchased from the Office of Alien Property Custodian, Chicago 3, Ill., for one dollar each. The set of original abstracts, covering some 8000 patents in the chemical field, may be had for $25 from that office.

● An "Industrial frequencies" chart has been made available by Sherman Industrial Electronics Co., Belleville 9, N. J. Emphasized on the chart are spectra from 69 cycles power through the germicidal and X-ray frequencies.

● A copy of the "Code for the prevention of dust explosions in the plastics industry" may be obtained from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass., for twenty-five cents.

● Three supplements to the A.S.T.M. Book of Standards, biennial publication of the American Society for Testing Materials Philadelphia 2, Pa., have recently been announced. Designed to keep the original book up to date, the supplements have been published in three parts and give some 230 specifications, tests and definitions either issued for the first time in 1945 or revised since their appearance in the 1944 book. Covered in Part I are ferrous and non-ferrous metals; in Part II, constructional non-metallic materials; and in Part III, general non-metallic materials.

● Clover Manufacturing Co., Norwalk, Conn., has released two bulletins, No. 3 on "Testing Coated Abrasives" and No. 4 on "Belt sanding of metal and the polishing lathe." No. 3 deals with standard samples, wood-sanding and metal-sanding tests and field testing. No. 4 describes the set-up wheel, use of the polishing lathe with abrasive belts, contact wheels, belt speeds, removal of metal and finishing, backstands, alignment of belt, length of belts, abrasives used.

(Please turn to page 202)

CONTINUOUS EXTRUSION PLUS FABRICATION

In One Operation

Here's another Yardley development that saves time and cuts costs. These plastic floats for plating tanks are extruded, sealed and cut in a single continuous operation.

Let Yardley engineers study your needs and products. Chances are they can suggest similar production improvements that eliminate extra fabrication steps.

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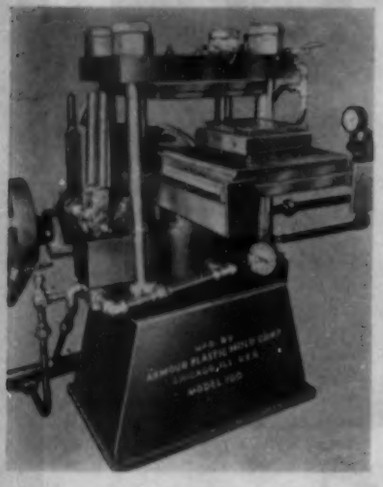
Fabricators of SARAN, CELLULOSE ACETATE, BUTYRATE, POLYSTYRENE, STYRALLOY and VINYLS. Also fabricators and [illegible]

New Machinery and Equipment

● Armour Plastic Mold Corp., Chicago, Ill., has manufactured a compression press of all-welded steel construction with a 10-in. ram providing 150 tons capacity. The

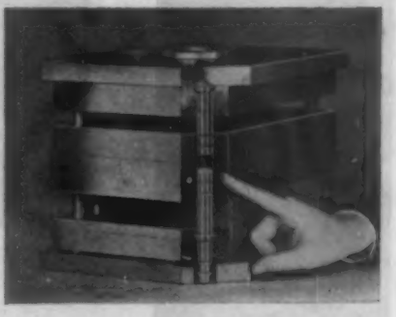


press can be used for a variety of work. When used for pressing phonograph records, the unit is equipped with front rails on which book-type molds are moved in and out of the press automatically by an air cylinder. The press can maintain an 18-sec. molding cycle on this type of work. When used for hand molds, it is equipped with automatic pushbacks. By reason of the small size of the machine, six units can be housed in a space measuring 20 by 30 ft., together with steam generator, preheating tables and hydraulic system.

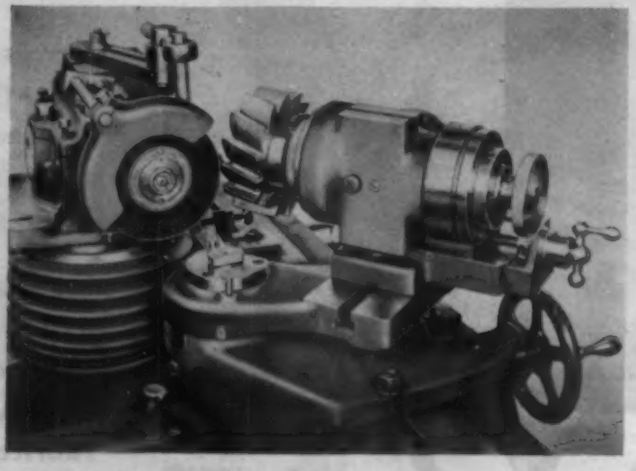
● A new saw for plastics, the Zephyr 16, just announced by the DoAll Co., Minneapolis 4, Minn. The saw, above, has been designed for speedy cutting of plastics, laminates and composition materials. It has a 16-in. throat depth and a 10-in. work thickness capacity, and the table can be tilted in 4 directions with provision made for circle cutting, ripping, straight and compound angle cutting. Featured is a variable speed assembly for selecting any speed range from 1000 to 5000 f.p.m. True cutting, straight eliminating chipping and increase in blade life are said to be possible by reason of the hardened steel saw guides with back up roller bearings.

● A solenoid-operated Giant Jaw heat sealer is a new development of Pack-Rite Machines, Div. of Techtmann Industries, Milwaukee 1, Wis. The machine is equipped with 30-in. hard chrome-plated sealing bars—either horizontal-krimped or flat—which heat seal large bags, pouches, sheets, etc., by merely pressing the safety foot switch which actuates the replaceable-ram solenoid. This arrangement eliminates foot pedals or pressure effort on the operator's part. A dial thermostat controls the temperature in the stainless steel-sheathed heating elements, with a range from room temperature to 550°. The unit may be used either horizontally on a work bench or vertically when installed on the side of a bench. So that the unit can handle wide bags, it is provided with a simple forward-backward adjustment.

● Development of a new mold base to expedite molding of plastic products and cut costs has been announced by Detroit Mold Engineering Co., Detroit, Mich. Features of the base include the fact that 1) return pins (4 in number) are installed directly in line with leader pins; 2) dowel pins are completely eliminated in the cavity retainer plates; 3) there is more working space for location of water cooling lines and core pulling devices. The new base will be available in 9 standard sizes—



9 by 12 in. to 18 by 36 inches. Plate thicknesses will be from 7/8 to 3 7/8 inches. Larger and special size bases will be available on special order.



● For use on their No. 2 Cutter and Tool Grinders, Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has announced a new No. 2 radius grinding attachment which will grind from 0 to 1 in. radii on cutters from 4 to 12 in. in diameter, with flute lengths up to 3 inches. Desired radius is obtained through adjustment of a micrometer gage which is inserted into a tapered hole bored concentric with the swivel point of the attachment. This gage has a range of 1 in. and pivots 90° to positive stops. Zero reading in both positions indicates that zero radius will be obtained, and from this setting the cutter can be accurately offset, through two adjustable slides, to the desired radius as indicated by the direct reading micrometer which is graduated to read in thousandths of an inch. Both slides, which carry the mounting assembly, can be independently operated by a crank and screw. The complete upper part of the unit swivels on a large anti-friction trunnion. (*Please turn to page 188*)

BETTER STEP UP . . . . than Stay Put!

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● Mead Specialties Co., Chicago, Ill., has devised a pressed steel foot control valve which affords 3- or 4-way operation for use with air clamps, press vises and collet fixtures. An adjustable stop in the base of Model 4W foot control pedal provides a quick shift from one type of operation to another by means of a cam. The same combination of functions can be made by rocking the pedal from toe to heel as by moving the lever of the bench valve. It is claimed that the need for line filters is eliminated by the absence of sliding closures which are subject to damage by particles of foreign matter introduced through the air line. Valve seals are of the poppet type, lined with synthetic rubber, assuring airtight action and freedom from deterioration due to accumulation of oil or moisture in the line.

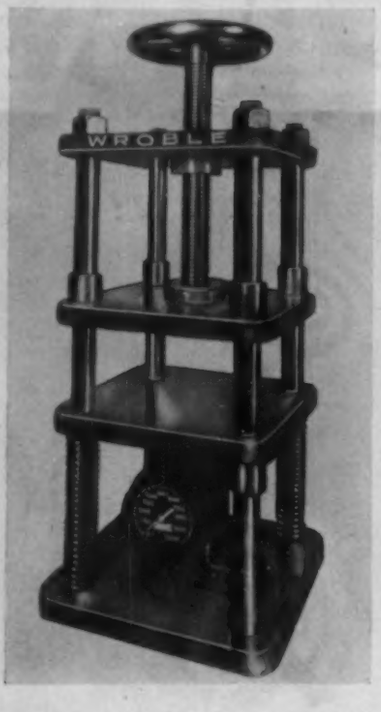
● The Transitank, a new portable fire-extinguishing unit with a capacity of 750 lb. of liquid carbon dioxide, is now being manufactured and marketed by Cardox Corp., Chicago, Ill. A unique feature claimed by the manufacturer is that it has an extremely high application rate of 300 lb. of carbon dioxide per min. from a single nozzle, thus enabling one operator to extinguish a relatively large fire in a matter of seconds. The unit has a refrigerated and insulated pressure vessel for storing the liquid at a constant temperature of approximately 0° F. and 300 p.s.i. By means of a patented snow separation nozzle, the carbon dioxide yields 47 percent CO_2 snow (finely divided particles of dry ice), thus providing increased cooling effect and more effective projection.

● A portable, completely self-contained dust collector which requires no installation other than placing it in position and plugging into the lighting circuit, has been announced by Aget-Detroit Co., Ann Arbor, Mich. Two stages of air cleaning are incorporated in this unit. The first removes all heavier dust and dirt as well as lint, bristles, etc., by means of the cyclone separator. The second is the fire-safe spun glass filter which gives the air a final cleaning to remove finer particles of dust before it is returned to the room.

This Model 421 has a built-in grinding wheel hood in addition to the motor-driven fan, cyclone separator and filter. The hood has a removable pan which allows sludge from wet grinding operations to be emptied separately, while a baffle plate in the hood prevents small work from being drawn by suction into the fan and, at the same time, spreads the effective area of suction.

● Fonda Gage Co., Stamford, Conn., has introduced a complete 82-piece set of lifetime carbide gage blocks which are made of fine carbide, abrasion-resistant and specially processed to prevent chipping and cracking. Their abrasion-resistant qualities cut down to a minimum the danger of damage from improper handling and extend the use of the blocks in the shop. Sizes in the set range from 0.050 to 4.000 in., including a 0.10005-in. block. Blocks up to 1 in. are solid carbide; 2-, 3- and 4-in. blocks are carbide-tipped.

● A new four rod universal hydraulic press has been manufactured by Wrobel Engineering Co., Schenectady 3, N. Y., for plastic molding and compression tests. The press is equipped with both high-speed



and high-pressure pumps for rapid pressing to save time and effort. It can be operated hydraulically by means of a hand pump, or it can be used as a hand-operated screw press. In either case, the load applied is registered on a gage, which is said to be a feature exclusive with this company. When used as a screw press, the capacity of the unit is determined by the lever arm used on the handwheel, but 5 tons is considered a practical limit.

● The Keyn Airflex, a new spinner-riveter put out by Plymouth Engineering Co., Plymouth, Ind., for all types of cold headed assemblies, is well adapted for use in assembly work on such materials as plastics, fiber, canvas and insulating materials. A feature of this riveter is an adjustable spindle regulator for precise control of riveting force under maximum speed which increases the scope of the riveter so that it can be used for cold heading on either ductile or brittle materials. A wide range of piston sizes, from $\frac{1}{2}$ to $1\frac{1}{2}$ in. to handle work up to $\frac{1}{2}$ in. diameter, makes possible the riveting of small as well as large parts. Pneumatic hammers are interchangeable over the entire range of sizes of rivets.

● A carbide slitting saw, made with a steel hub which is said to greatly reduce tool breakage, has been announced by Gay-Lee Co., Ferndale, Mich., for use with plastics and ceramics. The hub is permanently bonded to the cemented carbide blade, thus eliminating fracturing due to the strain imposed by mounting screws and nuts. This assembly also serves to support the cutting edge. The saw has a generated tooth design providing maximum strength, and a slightly concave shape insuring proper clearance. Standard sizes are from $\frac{1}{4}$ to 1 in. in diameter and from 0.015 to 0.060 in. in thickness; special sizes can be made to a manufacturer's individual specifications.

● Peerless Gear & Machine Co., Toledo, O., makes Peerless standardized pinions and racks for plastic dies. The special flame hardening of the teeth of these parts is said to improve the tensile strength while leaving the inner core soft enough so it resists the sudden shocks which accompany the ejection of plastic parts from the mold. This company's system of ejection is based upon the rolling action of gear teeth which act to "jack" out the parts rather than "bumping" them out. Pinions and racks are available in standard sizes and special sizes can be manufactured to specification.

● Special two-piece sealing bushings held tight against the surface of plug by line pressure on end of bushing or by heavy rustproof springs when no line pressure is present, are a feature incorporated in the Yarway hydraulic valve manufactured by Yarnall-Waring Co., Philadelphia, Pa. Single pressure valves are available for working pressures up to 5000 lb., two-pressure valves are recommended for operation with hydraulic presses such as are used in the manufacture of plastics. The single pressure valve is available in 5 sizes from $\frac{1}{2}$ to $1\frac{1}{2}$ in., both screwed and flanged, and in 3 styles—2-, 3- and 4-way—for maximum pressures of 1500, 2500 and 5000 lb. When the two-pressure valve is used on a straight stroke machine the top of the plug is fitted with a 4-tooth ratchet; for interrupted stroke machines, an 8-tooth ratchet is provided.

● Designed particularly for use in fabrication of metal, wood or plastic small parts is the high speed bench drill for $\frac{1}{8}$ in. drills and smaller which has been brought out by Dumore Co., Racine, Wis. With the help of a locking device, a solid steel column holds the drill head firmly in the desired position. This lock also holds the motor in place while permitting vertical adjustments and a 360° radius of action. Operation is accomplished through elevation of the table to drill by means of a hand control geared to the table. Power is supplied by a $\frac{1}{30}$ hp. motor with a range of 2000 to 15,000 r.p.m. Speed is controlled by a foot rheostat which permits the operator free use of both hands.

EIGHT PLASTIC PARTS
TWO PLASTIC MATERIALS
TWO PROCESSING METHODS
ONE RAZOR ASSEMBLY

Each part exemplifies precision unto itself and in relation to the various other components in the assembly.

Consolidated designed and built all of the dies—and processed all of the parts!

Some cases and covers were injection molded of Polystyrene—others, compression molded of Urea. The two hair pockets, the two attachment plug halves, the cord ring and transparent headguard were injection molded of Polystyrene.

When the eight finished pieces are brought together, they become an accurate plastic assembly of individual precision parts.

Consolidated treasures these "pieces of eight" . . . We show them to not only highlight our plastics experience, skill and completeness—but to also indicate our desire to take on more, similarly intricate problems. Your inquiry is therefore invited.

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News of the Industry

● The two-year research contract awarded to Princeton University by the Army Signal Corps will be aided by the efforts of a 9-man committee appointed by American Society of Testing Materials. This committee consists of J. D. Ryan, Libbey-Owens-Ford Glass Co., chairman; A. G. H. Dietz, Mass. Inst. of Technology; W. O. Baker and K. G. Coutlee, Bell Telephone Lab.; D. Telfair and H. K. Nason, Monsanto Chemical Co.; C. R. Stock, American Cyanamid Co.; G. H. Mains, Phenolite Co.; and Arthur J. Warner, Fed. Telecommunications Lab., secretary.

● Kampa Mfg. Co., Milwaukee, Wis., is constructing a plant which will afford the company approximately 22,000 sq. ft. of floor space.

● Plastic Enterprises, Inc., Bloomfield, N. J., has constructed a large plant, with 4 compression and 4 injection presses of varying sizes, for the designing and production of molded plastics of all types.

● Plastic Research Products Laboratories have moved to Urbana, Ohio.

● Dow Chemical Co. has opened a Toronto, Ont., plant for the production and sale of plastics.

● General Electric Co. is planning the construction of a plant at Wallingford, Conn., for the manufacture of plastic molded parts.

● A program to double the manufacturing facilities for Geon polyvinyl resins announced by B. F. Goodrich Chemical Co., includes enlarged quarters in Cleveland, Ohio.

● A new company, Harwill, Inc., located in St. Charles, Mich., has been formed to manufacture plastic articles.

● A new silicone product, DC Antifoam A, has been developed by Dow Corning Corp., Midland, Mich. It is anticipated that this product will be effective in killing foam in alkaline black liquor, rosin soap solutions, sodium oleate and sodium alkyl sulfate solutions, Aerosol OT, cutting oil emulsions, egg albumin and various synthetic rubber latices. The antifoam is designed to be used in very low concentrations ranging from 1 part in 10,000 against strong foamers to 1 part in 1,000,000 against weak foamers.

● Further research on nylon and other plastics and synthetic materials at Northwestern University has been made possible by the donation of $9350 from E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del., and Richardson Co., Melrose Park, Ill.

● A new plant has been planned by Cluett, Peabody & Co., Inc., in Troy, N. Y., for the research and scientific studies of non-woven fabrics and non-shrinking threads, improvements in plastics, textile finishes and processes.

● Casein Co. of America, New York 17, N. Y., has announced a new durable resorcinal resin, a dark wine-colored liquid adhesive, which will be marketed under the trade name of Cascophen. Developed primarily for gluing wood, the product has been found effective in bonding practically any material with some degree of porosity. It requires only sufficient pressure to insure good penetration into the surface.

● Atlantic Plastics, Inc., has announced the removal of its plant from Woodside to Flushing, N. Y.

● Plastic Engineering Co. has moved to larger quarters in Dunnell Lane, Pawtucket, R. I.

● The Plastic Doll and Toy Co., New Baden, Ill., has been incorporated for the manufacture of toys and dolls made from plastic materials.

● Announcement has been made of the removal of Transparent Container Co., from Brooklyn, to Kingston, N. Y.

● Levin Mfg. Co., makers of plastic novelties, has completed negotiations for the leasing of a building in Long Island City, N. Y., from the Plant Maintenance Corp.

● Prince Industrial Plastics Corp. has moved to larger quarters in Cleveland, Ohio.

● Southeastern Veneer Co., Denmark, South Carolina, has been purchased by Hamilton Veneer Co., a subsidiary of U. S. Plywood Corp. New facilities will furnish centers and cross-bands for the mother corporation's plant in Algoma, Wis.

● C. C. Coates has formed Royal Mfg. Co., Prescott, Ariz., to manufacture plastic and metal products.

● The Borton Plastic Molding Co., has been established in Akron, Ohio, to do proprietary molding.

● Modern Molded Plastics, Ltd., St. Johns, Quebec, has recently been incorporated to do compression molding of thermosetting phenolic and urea-formaldehyde plastic compounds.

● According to a recent announcement, Grayhill, Chicago 24, Ill., manufacturers of industrial electrical switches, is now equipped to mold small phenolic pieces on a low production basis.

● Tilo Roofing Co., Inc., has purchased all outstanding stock of Glasfloss Corp., Hicksville, N. Y., manufacturers of glass floss. The property will be operated as a separate unit of the company.

● Anesite Co., Chicago 12, Ill., has been formed by William Hess, formerly production manager of Midwest Molded Products Co. The firm will engage in the extruding of plastics.

● Louis K. Braunston has created Moldex Rubber & Plastics Corp., New York, N. Y., with branch offices in Akron, Kansas City and Los Angeles, to serve industrial manufacturers who use molded and extruded plastic and rubber items.

● C. K. Castaing, formerly with Nu-World Products Co., has formed his own firm to continue his work of designing, forming, flowing and engraving of plastics, to be known as C. K. Castaing Studios located in Huntington Beach, Calif.

● Pliatab cold padding glue is a new product of Paisley Products, Inc., Chicago 16, Ill. It is a liquid plastic resin which is claimed to have great covering qualities and be resistant to extremes of temperature and climatic conditions. It can be applied either by hand brush or spray gun.

● To meet the increasing demands for Lumite window screening and upholstery materials, Chicopee Mfg. Corp, subsidiary of Johnson & Johnson, is planning a new mill at Cornelia, Ga., which is expected to be ready for operation by August 1.

● To relieve a postwar bottleneck in paint production, Goodyear Tire & Rubber Co., Akron, Ohio, has announced a new synthetic copolymer resin, Pliolite S-5. It is said to offer advantages in acid and alkali-resisting coatings, concrete floor enamels, architectural finishes of all sorts including wall paints, trims, floor paints, metal primers and finishes, oil and grease resistant coatings, baking enamels, corrosion resistant coatings for water tubs, ship bottoms, etc.

● Marvin Schneider, former director of plastics division, York Research Corp., has formed Applied Engineering Assoc.,

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Queens, N. Y. The company expects to handle engineering problems in plastics, design, industrial market research and engineering liaison.

● A new internal-curing insulating varnish has been announced by Irvington Varnish and Insulator Co., Irvington, N. J. Known as Harvel 912C, it is claimed to cut curing time by one half, and provide greater dip-tank, storage stability.

● Penn-Plastics Corp., has announced its removal to Fairhill Ave., Glenside, Pa.

● The Nu-Dell Plastics Corp., Chicago 39, Ill., succeeds the former partnership of Nu-Dell Mfg. Co.

● Standard Molding Corp., Dayton, Ohio, has moved to larger quarters in the same city.

● Plastic Seal, Inc., Louisville, Ky., has installed larger capacity presses to take care of laminated plastics articles.

Personnel changes

● M. E. DAVIS, formerly with J. M. Huber, Inc., now heads the new Trenton, N. J., office of Standard Chemical Co., whose headquarters are in Akron, Ohio.

● M. V. KEMPER is Mid-Western sales engineer for Improved Paper Machinery Corp., Nashua, N. H. Mr. Kemper, former plastic engineer for Inland Mfg. Co., Div. of General Motors, will be located in Dayton, Ohio.

● BLAIR GIBSON, former superintendent of United Plastics Div. of Ideal Novelty & Toy Co., has joined the staff of Reed-Prentice Corp., Cleveland, Ohio, in the capacity of field service engineer.

● Bakelite Corp., New York 17, N. Y., has made the following changes: FRANK KIEFER is merchandising manager of consumer goods; W. J. CONNELLY, manager of consumer relations in charge of lectures, etc., both civic and semi-technical; and RUSS W. MATTHEWS is sales promotion manager in charge of exhibits.

● H. P. FELL and C. S. LEONARDSON have been named vice-presidents of the Casein Co. of America, Div. of Borden Co., New York 17, N. Y. Both men, in addition to NILS ANDERSON, JR., have also been elected members of the directing board. A. F. GRIGNON has announced his retirement as vice-president and member of the board.

● HOWARD R. GAETZ is plant superintendent of the synthetic rubber plant of United States Rubber Co. at Naugatuck, Conn.

● MALCOLM WOLCOTT has joined the sales staff of Formica Insulation Co., Cincinnati, Ohio. Mr. Wolcott will work in the Rochester, N. Y., territory.

GEORGE P. ANDERSON

● GEORGE P. ANDERSON has been appointed president of Badger Plastics, Inc., Fond du Lac, Wis. He was formerly connected with Hydraulic Press Mfg. Co. and Auburn Button Works, Inc.

● Appointment of RICHARD H. DEMENT as assistant in charge of Armorply Div. of U. S. Plywood Corp., has been announced. LAWRENCE V. DALTON is the Connecticut sales representative for this company.

● Hercules Powder Co., Wilmington, Del., has announced eight additions to sales offices in six districts. FRANK H. CRYMES will locate in San Francisco office; WILLIAM POWER and JUDSON HURD, New York; GEORGE OSBURN and JORDAN P. SNYDER, Chicago; WILLIAM A. WOODS, Boston; CHARLES HUHN, Wilmington; and COLEMAN EDGAR, Cleveland, Ohio. ARTHUR L. PERRY was elected assistant treasurer of the company at the annual meeting of the board of directors.

● CHARLES KELLER is superintendent of the plastics div. of Fabricon Products, Inc., River Rouge 18, Mich.

● DR. PAUL O. POWERS has been named to the staff of Battelle Memorial Institute, Columbus, Ohio.

● M. SCOTT MOULTON has been promoted to technical service manager of Geon thermoplastic materials for B. F. Goodrich Chemical Co., Cleveland, Ohio. WILLIAM I. BURT has been elected vice-president-manufacturing and DR. FRANK K. SCHOENFELD, vice-president-technical.

● Promotions in the plastics division were announced recently by Celanese Corp. of America, New York, N. Y. HAROLD L. SHEPPARD is plant manager of the recently acquired plant at Belvidere, N. J. CHARLES C. ECKERT is production superintendent and JAMES R. KENNEDY, plant accountant at Belvidere. HARRY COOPER, who will be superseded by FRANK T. VAN DYKE as superintendent of the manufacturing dept. at Newark, N. J., is now assistant plant manager. ALBERT G. BINDER is plant purchasing agent at Newark. The same announcement named C. M. CROFT as manager of the Celanese Mexicana, S. A., a new plant under construction at Ocotlan, near Guadalajara, Mexico.

● DONALD WHITE has joined the staff of Steiner Mfg. Co., Brooklyn, N. Y.

● J. W. BARNETT of Barnett Plastics, Inc., Atlanta 1, Ga., has resigned his position as president but will continue to serve on the board of directors.

● GEORGE W. FRICK has been appointed executive vice-president of Carbide Die & Mold Co., Pittsburgh 20, Pa. Mr. Frick will also direct the company's sales.

● P. P. WOJTUL, former assistant to the vice-president and comptroller of Continental Can Co., Inc., New York 17, N. Y., has been made assistant to Hans A. Eggerss, executive vice-president. H. A. SWERTFEGER succeeds Mr. Wojtul.

● J. C. STONE, vice-president of Tennessee-Eastman Corp., New York 16, N. Y., has been elected to the board of directors to fill the unexpired term of EUGENE CHRYSTAL, who died in March.

● BERT L. MURMAN is president of Plastic Molded Products, Inc., Los Angeles, Calif. The company has moved to larger quarters on W. 6th Street.

● Several personnel changes have been effected by Atlantic Plastics, Inc., Flushing 1, N. Y. JOSEPH E. BENOIT is treasurer and assistant general manager; ROBERT I. GREENLAW is consulting engineer and LEO CIZESKI is factory superintendent.

● FLOYD D. DEAN has been appointed works manager of the new Washington, W. Va., plastics plant of E. I. du Pont de Nemours & Co., Inc. Also announced were the appointments to this plant of ROYAL C. BUNDY as works engineer and LEO A. LOUNEY, chief clerk.

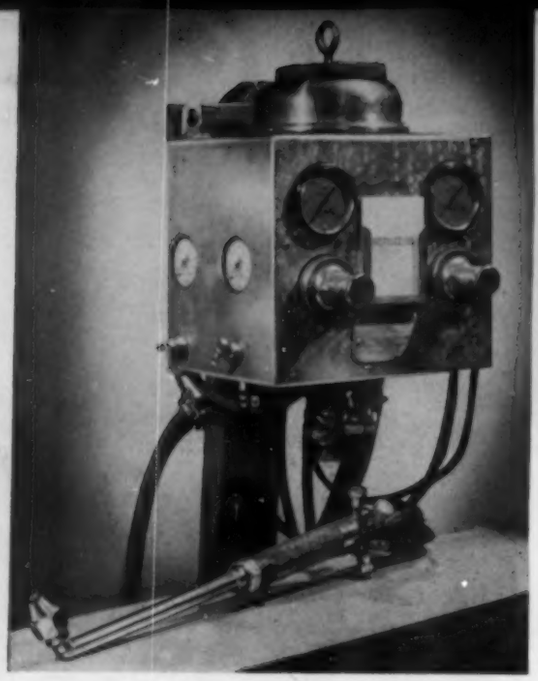
● At the annual stockholder's meeting of Fenwal, Inc., Ashland, Mass., two new directors were elected. They are: EDWARD J. POITRAS, director of engineering, and JOHN M. STORKERSON, general manager.

● LAURENCE R. SHERMAN has been appointed general sales manager of the Plastic Film Corp., Plainfield, Conn.

● DONALD A. METZ has been appointed manager of Technical Service for the Zapon Div. of Atlas Powder Co., Wilmington, Del. He will be located in the Stamford, Conn., plant.

Sorry!

● Through an oversight, we failed to mention in the article, "From trim-tab motor to hand mixer," which appeared on pages 100 and 101 of the May issue, that the material for the housing of the mixer was supplied by Nixon Nitration Works.



PHOTOS, COURTESY POWDER WELD CO.

Material is placed in container (shown at left) where it passes through tubes to the torch (above). From the torch, an oxygen-gas flame is projected from a ring of jets around a center opening through which powdered plastics may be discharged. A cooling or processing gas is emitted around the flame. The flow of the plastic can be closely controlled

Applying plastic coatings

Equipment resembling a blow torch is used in this process to project the coating

A NEW flame spraying process, called Powder Weld, that may serve as a practical aid in applying plastic coatings, is now on the market. Described as a method of welding, brazing or surfacing with infinite compositions of powdered materials, the system makes use of equipment produced by the Powder Weld Company that consists of a torch (made in the general outlines of an ordinary welding torch) having a special patented nozzle and 16 independent controls, a control box with air and gas-pressure regulating valves and a canister from which various powdered materials are fed through the flame.

Mechanical mixtures or chemical compositions of powdered or finely divided metals and alloys, together with suitable fluxes, are projected through the flame cone onto the work surfaces. Fuel gas, oxygen and a processing gas are used in combination to provide temperature and atmosphere control. The tools are precision made to permit accurate control of the flame temperature and atmosphere, the target or work surface, temperature, and the temperature of the material. Any welder or spray gun operator can learn to operate the system with one day's training.

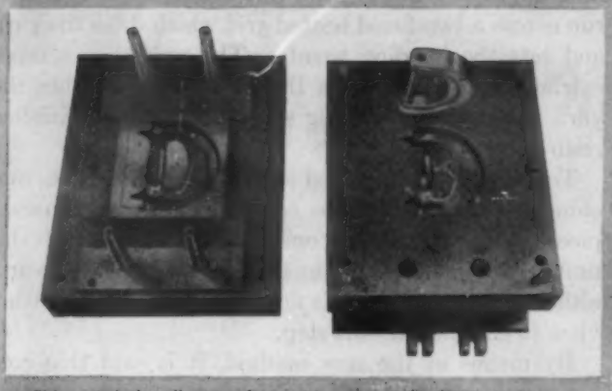
It is asserted that any material which is reasonably stable in a flame and can be fragmented to a mesh size of 80 or below can be used with this process. Phenolic molding powder, for example, is a mesh size of about 8 or 10. The powdered material for use with this process must also be free flowing so that agglomeration in the system will be avoided. The inventor points out that several reactions are possible as plastic material passes through the combined gases.

When used for coating, the equipment can lay down plastic material in any thickness down to just enough to provide a continuous film. The one limitation is that the plastic must have a reasonably well-defined liquid range to insure an even continuous covering on the base. Plastics such as polyethylene may be sprayed hot and wet to give a transparent coating, without degrading the material. The inventor anticipates that a number of other resins, particularly elastomeric types, will be used in this way as the process becomes more generally known.

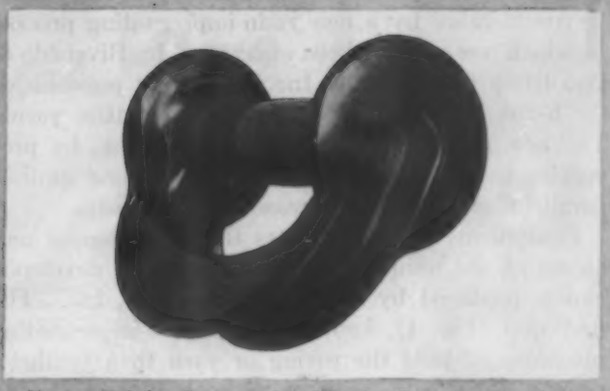
Rapid and simple change-over from one material to another is one of the advantages of the system. It is possible to switch from a heavy metallic powder to a light plastic without changing any part of the torch.

Very little compressed air equipment is needed as the volume used is small but at high pressure (80 p.s.i.). The processing gas may be carbon dioxide, nitrogen or any other inert gas available. It is believed that the equipment would be most valuable in laboratories where research men might find it useful as an aid in studying the effect of heat and mixed gases on various materials. The complete equipment weighs about 50 pounds. Production is just getting under way with most of the units going into laboratories for testing and research work.

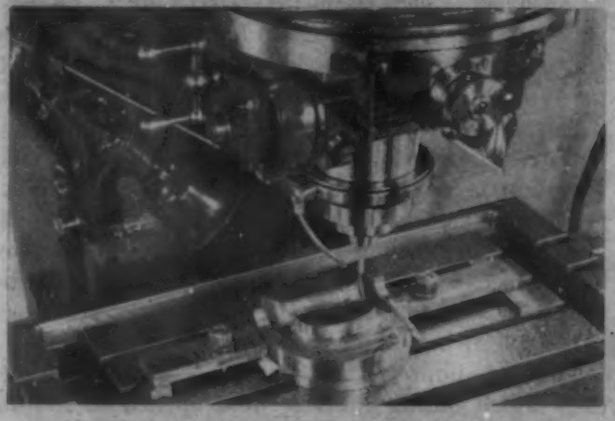
Could you machine this Mold without the Cost of Templets or Models?



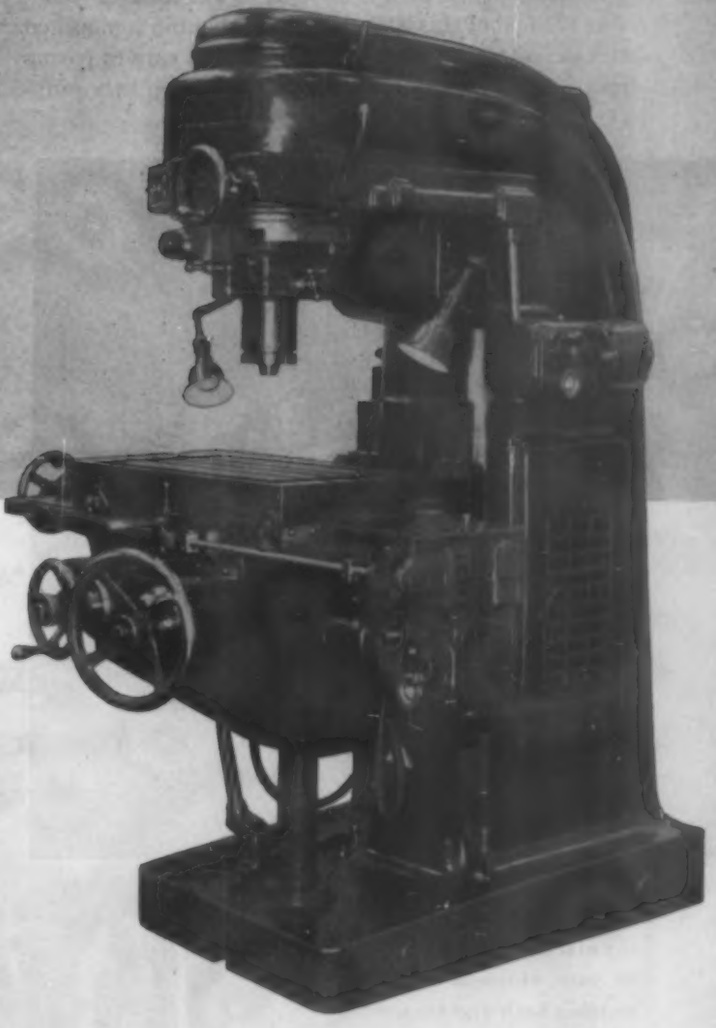
This switch handle transfer mold, using SAE 3012 steel, was made from blueprint dimensions without model or templet.



Plastic switch handle as produced by the Kline Manufacturing Co., Galena, Ohio from mold illustrated opposite.



Making complete mold on a K & T Rotary Head Milling Machine assured exact production to drawing specifications — reduced total production costs.



TOTAL TIME for complete mold was 35 hours, employing an inexperienced operator. Little hand-finishing was required. With more operating experience, time could be reduced by milling both halves of the mold in one setup. This is just one example of the outstanding performance a Kearney & Trecker Rotary Head Milling Machine can give you in toolroom, experimental and manufacturing work. SAVES TIME — it mills intricate shapes in a single setup, transmits blueprint dimensions direct to the workpiece without aid of models or templets. AVOIDS ERRORS — it gives you exact control of all mechanical movements. SAVES MONEY — initial preparation and multiple setups are eliminated. Production goes up — costs go down. For further information, write for Bulletin 1002C today!

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC BORING MACHINES

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Products

CORPORATION

MILWAUKEE 14, WISCONSIN

Subsidiary of Kearney & Trecker Corporation

A new yarn-impregnating process

THE outlook for the textile industry is brightened considerably by a new resin-impregnating process which has recently been announced by Riverside & Dan River Cotton Mills, Inc., suggesting possibilities for better, stronger, more economical cotton yarns. The new method, known as Fiber-Bonding, by preventing the slippage of one cotton fiber along another parallel fiber, is said to increase tensile strength.

Equipment which completes the impregnating and curing of the resin in two stages has been developed and is produced by Walter Kidde & Co., Inc. The first unit (Fig. 1), known as the yarn-impregnating machine, subjects the roving or yarn to a synthetic resin wetting bath, with or without a pigment, and rewinds the impregnated material on a second spool or bobbin. Yarn then is allowed to age awhile.

At the end of this time, the loaded bobbin is mounted on a second unit (Fig. 2) which feeds the yarn or roving from its supply spool with uniform tension to a snubbing device. While still on this machine the roving is run across a two-faced heated grid which dries the yarn and sets the bonding agents. The unit then scrapes extraneous material from the roving and polishes the yarn surface. A receiving spool takes up the finished resin-bonded yarn.

To simplify and speed these operations the machinery manufacturer has combined the two separate pieces of equipment into one unit. But even with this unit it is still necessary to age the resin-treated yarn, although research work is now being carried on with a view to eliminating this step.

By means of the new method, it is said that conventional processes such as spinning, spooling, warping and twisting are eliminated. There is also reported to be an average increase in tensile strength of rovings, yarns or cords ranging from 40 to 60 percent. As this will affect even short-staple rovings or yarns, it will mean that it will be easy to fabricate low-grade cottons which are not suitable for conventional cotton manufacture, thus greatly widening the field of cotton consumption in one direction. In the other direction, machinery and technique are reportedly being developed which will make feasible fiber bonding by multi-processing instead of by working only with single ends. By this step the process may be applied to finer yarns and rovings at a cost that is not prohibitive.

The resin-impregnating method is similar to processes which during the war were applied to netting cloths, thereby largely eliminating their tendency toward slippage. After extensive research and experimentation, the Fiber-Bonding process, as well as the machinery, has been modified to the point where it is thought that the new procedure might be used successfully with synthetic and other plant fibers besides cotton.

1

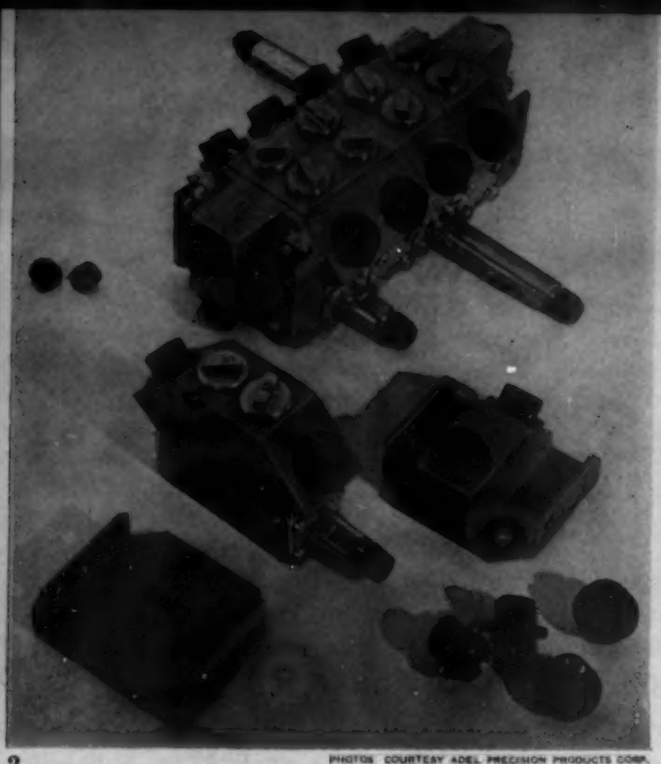
2

PHOTOS, COURTESY RIVERSIDE & DAN RIVER COTTON MILLS, INC

1—The yarn-impregnating machine carries roving or yarn through a resin wetting bath and then rewinds it to be aged. 2—After aging, the roving is cured on the second machine where any foreign matter is also removed


We're Eight Months Along...
One month more....and then we hope to announce the "successful delivery" of our new prodigy "PLYON". Conceived to serve in an unending array of new applications, we predict a most successful growth by many, many users.
During this pre-announcement time we have "labored" without let up...in test after test to assure its fitness to bear our name and our guarantee. We know what "PLYON" can do; how it can best be applied to solve each specific problem.
And what is "PLYON"? Well, the announcement comes next month, but, in the meanwhile we'll steal a flash on Winchell. We can say that it is a plastic decorative material that is destined to influence many of the things of your everyday use...from lighting fixtures to construction materials.
So until our "blessed event", when we'll tell you all,
Sincerely,
Dave Swedlow
Dave Swedlow
Swedlow PLASTICS CO.
5527-33 District Blvd.
Los Angeles 22, Calif.

1



2

PHOTOS COURTESY ADEL PRECISION PRODUCTS CORP.

1—Plastics are increasingly employed in manufacturing equipment. Here a low-pressure fluid valve utilises cellulose acetate butyrate caps and a molded phenolic coil spool which have been tested for resistance to shattering, moisture and aromatic fluids. 2—Screw plugs on this aircraft hydraulic equipment are of molded butyrate and are used to protect open ports from dirt and possible damage

Plastics in precision hydraulic equipment

by WILLIAM LAWRENCE LEWIS*

PLASTICS are finding increasingly widespread use in many industries devoted to various phases of manufacturing and transportation. For instance, they are being used in many ways and in various forms in aircraft hydraulic equipment. In all cases, their success can be attributed, in no small measure, to the proper selection of materials—and the designing of each and every plastic part with expert regard for long, trouble-free life.

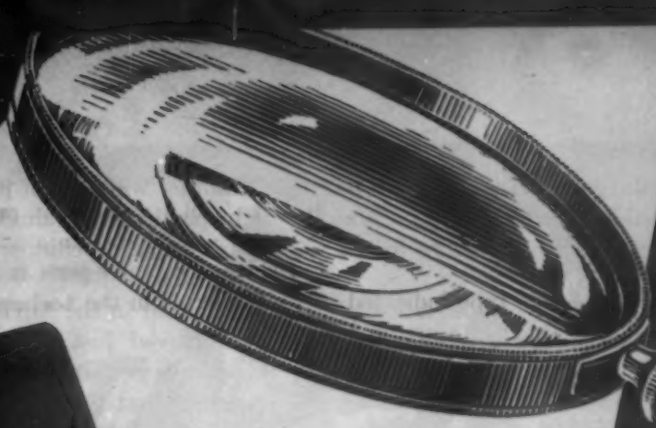
Selecting the right materials for parts is sometimes a very difficult matter because of unexpected reactions to unforeseen conditions. Even laboratory tests cannot always be depended upon for the right answer. The plastic caps and switch housings used on high-pressure solenoid-operated valves produced by Adel Precision Products Corp. were formerly molded of a plastic which appeared, when tested, to have all the desired characteristics. However, after passing the specified tests in the experimental laboratory, and being officially certified for aircraft use, the parts were found, when put in service, to be susceptible to attack by fungus growths peculiar to certain areas in the South Pacific. Upon examination, it was discovered that the woodflour used as a filler in the molding material caused fungus to germinate when exposed to the hot, humid atmosphere of the tropics.

A different kind of trouble occurred with this same plastic switch housing after the valve, of which it was a part, left the factory. Soldering of electrical connections in the field was done less carefully than under the controlled manufacturing conditions within the factory. It was apparent from the conditions of the valves returned for repairs that an excessive amount of heat was sometimes used in the soldering, causing the plastic to expand and crack around hold-down screws. While this is an example of misuse, it was reason enough, in view of the material's tendency to allow fungus to germinate, to cause another material to be substituted for the molded housings.

After testing several likely materials, this equipment manufacturer selected Melmac 592 for this part, and no more trouble was experienced with fungus growths or cracking from undue soldering heat. While this plastic has relatively low impact resistance, it has sufficiently high strength in tension and compression to be entirely satisfactory in this application. Being a mineral-filled, melamine-formaldehyde plastic, it successfully resists fungus. Having a dense hard surface which is very smooth, it does not accumulate moisture. It also passed tests for resistance to specified chemicals, acids, aromatic fuels, oils and gasoline, and furthermore, possesses good dielectric qualities.

As another case in point, take the electrically operated fluid selector valves which are an indispensable part of many hydraulic systems. Switch contacts and terminal connections are contained within a molded plastic housing (discussed above), the top portion of

* Aeronautical Engineer.



THE CASE OF THE LIGHTER

held no mystery for us

—and will hold no mystery for you either when you see how these beautiful Ellis Lighters sell over the counter in their sparkling Creative housings. If your need is an elaborate housing, panel, or just a knob or bushing, send your specifications to Creative for an analysis.

Plastics Specification Quiz: If it's not convenient for you to send blueprints or samples, write for our "Plastics Specification Quiz". Two minutes with this Quiz will enable you to tell us which of your products may be improved by the use of plastics.

Creative

PLASTICS CORP.

0 Kent Avenue **Brooklyn 5, N. Y.**

which is removable for making electrical connections to the control circuit. When replaced, this top portion or cap prevents the entrance of any moisture to the electrical circuit.

Service tests made on valves of this type indicated that these plastic caps needed to have a somewhat higher impact resistance than the caps on the valves previously described. This was due, in a large measure, to these valves being in more open locations where they are frequently exposed to damage from tools in the hands of mechanics working on adjacent equipment. This consideration dictated the use of a Tenite II compound of sufficiently high impact resistance to resist shattering from accidental blows.

While this plastic is attacked to some extent by aromatic fuels, the likelihood of extended contact with such liquids is very remote. Many thousands of these valves, in service for several years, attest to the high quality of the material selected for this particular purpose. The form on which the solenoid coil is wound is molded of Bakelite XM-15,000. Melmac 592 is also used for the same purpose. Threaded brass electrical connection inserts are molded with the coil form.

Another wide use of plastics—one which has proved to be particularly valuable as a precautionary measure—is in molded cellulose acetate butyrate screw plugs which close valve ports to keep out dirt. These plugs are inserted in the Adel equipment at the factory and are removed just prior to installing the equipment. They have performed a valuable service in assuring the customer that the equipment when received in distant locations will be in perfect order.

After final assembly testing in the factory, all hydraulic selector valves and similar equipment are put into cellophane bags which are then hermetically sealed by the application of heat and pressure to the folded open ends. This procedure protects the parts from possible damage caused by exposure to the elements. Being transparent, the bags plainly reveal the contents at a glance.

From the foregoing, it is apparent that plastics, in connection with precision hydraulic aircraft equipment, perform in an eminently satisfactory manner the functions for which they are designed. These are not substitute materials but ones which have been selected because they do the work better than anything else.

Nitrocellulose coating protects glass containers

Here's a break for chemical laboratories whose shipping costs run high as a result of broken chemical containers. By coating a glass bottle with a nitrocellulose plastic produced by Hercules Powder Co., an outer layer is formed which is tough enough to withstand greater force than it would probably meet under ordinary circumstances. The glass may shatter but the plastic remains intact, containing the liquid until there is time to put a new bottle into use.

Detroit Macoid Corp. does the coating, at the present time using one-gallon bottles which are dipped in a special solution of the nitrocellulose. After the excess plastic has dripped off, there remains an even conforming film 10 to 20 thousandths of an inch in thickness which dries on the bottle. The result is actually a plastic bottle which is formed securely over a glass one.

Proof of the coating lies in a spectacular demonstration in which a coated bottle was thrown with great force against the side of a heavy steel office safe. The glass bottle itself was completely shattered by the force of the impact but the plastic "bottle" was undamaged. Not a drop of sulfuric acid which was contained in the glass bottle was lost.

Of course in the case of strong acids, a strong chemical reaction occurs when it contacts the nitrocellulose coating. This would eventually result in destruction of the bottle coating and cause leakage, but most acids would be held long enough for the breakage to be discovered and the dangerous contents transferred to an undamaged bottle.

This type of protection for bottles was developed during the war and is expected to meet with wide acceptance by chemical laboratories and plants for both shipment and storage of dangerous liquids. The cosmetics and pharmaceutical industries may also be quick to adopt this method of shipping costly essences, serums and so forth. The little time and cost involved in coating glass containers, they are finding, are well worth the effort.

The coating, although normally transparent, can be colored with dyes for quick identification of contents or for protecting the contents from light. Transparent or colored the coating allows the label on the bottle to be read and serves to protect it from becoming illegible through handling. Washing does not affect the coating in any way.

Strategically located to serve the needs of the entire West Coast, our two-acre plant is the largest of its kind west of the Rockies. We specialize in extruding all thermoplastic materials. We have become known to the consumer for our vinyl garden hose (⅓ as light as rubber and much longer-lived) our extruded shelf edging and other home applications. Industry knows us as a source of reliable custom extrusion. We work from ideas or blueprints and our engineers and production facilities are equipped to handle all industrial extrusion problems. In addition, we maintain a large stock of extruded rods, tubes, tapes and profiles for immediate delivery.

The whole country is talking about American Extruded Products. Try us and see for yourselves.

AMEPCO
FLEXIBLE RIGID DURABLE
LOS ANGELES

AMERICAN EXTRUDED PRODUCTS CO.

1001 N. LaBrea Avenue — Hollywood 38, California

Books and booklets

(*Continued from page 184*)

● The General Control Co., Boston 34, Mass., has released a catalog and handbook on manually operated foot switches. Types covered include the "press-anywhere" model for foot, knee or elbow operation; a wide range application model; a heavy duty unit; a flat switch for reduced fatigue; and a switch adaptable for home use and light machining.

● Six different models of Brinell testing machines, including manually operated and portable types, are described in a leaflet issued by Steel City Testing Laboratory, Detroit 4, Mich. Also shown is a universal model for tensile, traverse and compressions tests to 60,000 pounds.

● Bulletin 80 just published by Ampco Metal, Inc., Milwaukee 4, Wis., describes guide post bushings, a new line of aluminum bronze bushings designed to answer the problems of keeping blanking, forming and other die sets in alignment in spite of abuse and hard usage.

● "A Periodical Review of the South African Market" issued by Commercial Corp. of South Africa (Pty.) Ltd. and the Market Research Department of Plastics Products (Pty.) Ltd. is the first of a series of periodical reports designed to present industrialists, both overseas and in South Africa, with a picture of business trends in the Union. It also furnishes details regarding the potentialities of that market.

● Manufacturers using industrial processes which require the accurate maintenance of high temperatures will be interested in Vol. 9, No. 8, of "Weather Magic," publication of the Trane Co., LaCrosse, Wis., describing industrial steam traps.

● Formaldehyde is the subject of a leaflet issued by the U. S. Department of Labor as one in a series for controlling chemical hazards. Contained in the pamphlet are safety precautions to be used for prevention of exposure to high concentrations. It is available for five cents from the Superintendent of Documents, U. S. Govt. Printing Office, Washington 25, D. C.

A Plastic Center designed to serve not only as a showroom and merchandising mart, but also as a clearing house for information on plastics, has been set up in Boston, Mass., under the co-sponsorship of Beacon Products Corp. and New England Advertising, Inc. Dual-purpose of the project is to dispel some of the ignorance with which the public views plastics and to promote the general development of the industry.

Here trained experts are always on hand to answer the public's questions and to furnish information and advice to the manufacturer, jobber, exporter or dealer beset with such problems as how to improve his product, his packaging or his advertising. Here too through educational displays the layman may gain a visual concept of the transition from plastics raw materials to finished products and of the applications to which each type of plastic is best suited.

Available for the exporter are field-tested items which have been tried out in foreign markets and been found to be successful in unrelated export areas. Ready for the jobber or dealer are low cost articles which are suitable for either consumer merchandising or advertising specialties and premiums.

A center devoted exclusively to plastics serves as both information bureau and merchandise mart, in this way maintaining a program of public education and providing helpful advice to manufacturer, jobber, dealer, and exporter alike

Yes, or alike as two telephone handsets made by the same process. Yet, pins or handsets — no two could ever be made exactly alike. Dimensions, weight, performance — all vary every time due to variables in manufacture. How can these variables be *controlled?*

Back in 1924, Bell Laboratories' mathematicians and engineers teamed up to find out, forming the first group of quality-control specialists in history. They invented the now familiar Quality Control Chart, designed inspection tables for scientific sampling. They discovered that test data mathematically charted in the light of probability theory were talking a language that could be read for the benefit of all industry.

Western Electric, manufacturing branch of the Bell System, applied the new science to its large-scale production. In war, it was used by industrial and government agencies of the United Nations in establishing and maintaining standards for military matériel. A Quality Assurance Department, a novelty back in the nineteen-twenties, has come to be indispensable to almost every important manufacturer.

Scientific quality control is one of many Bell Laboratories' ideas that have born fruit in the Bell System. The application of mathematics to production helps good management all over the industrial world — and furthers the cause of good telephone service.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

Refrigerator trays

(*Continued from page 123*) or flaking when subjected to a 180° bend. Film thickness and gloss are also carefully inspected, and color-retention requirements are that there should be no change of color after test panels are stored in a dark cabinet for a period of 90 days."

The latest test to be tried on the plastic coating was for acid resistance. The results showed that the finish could be in contact with lemon, orange, grapefruit and tomato juices, as well as beer, for a 48-hr. period without any staining.

Applying the plastic coating

Were it not for the difficulties encountered in getting a "complete envelope" when tin plating refrigerator shelves, there would be no reason to use another material. But with the presence of pits, pores, scratches, cracks and recesses, there is sure to be some untinned surfaces which allow rusting to begin. Other plating materials have always had similar drawbacks. Zinc will cover more completely, but the dull finish is unattractive and white oxidation is sure to occur.

This background is necessary for full appreciation of what this new resin coating means to the refrigerator people. So the new gleaming white shelf is certainly an addition to the family of refrigerator accessories. While the process of application is not simple, the new shelves are rolling off the finish line at high speed now that completed fully automatic equipment has been installed.

The Servel plasti-coated shelf starts out as a welded bar frame of premium cold-rolled steel. It is first pickled in acid to remove all oxides, grease, dirt and other foreign matter picked up during the preliminary steps of fabrication. Then it is electro-plated with zinc. This zinc plating is controlled between 0.4 and 0.8 of a mil, a thickness which field experience has proved will give most satisfactory results.

Next the shelf is coated with a Bonderite film to prepare the zinc plate for plasti-coating. Then the shelf is given a first coat of plastic. This coat is thermally set to the zinc plating at a temperature of 320° F. The final step is a finish coat of plastic which, in turn, is thermally set to the first coat at a temperature of 300° F. This thermal setting process produces a hard, smooth, durable finish which can be readily cleaned in warm, soapy water.

Since spray coating of pieces like refrigerator parts is impractical, quite elaborate equipment has been set up to facilitate the coating by the dip process.

The real problem here is the draining of the excess material. All this is drained off except for a number of little "tears" which, if allowed to remain, would form at the lower end of the shelf as it hung on a conveyor rack. In baking, these tears would not become as hard as the rest of the finish, and would soon break off and give a poor appearance.

How to get this last little tear off caused many a sleepless night for research men until the field of electronics gave the answer. After each shelf has been dipped and is on the way to the heat curing, the conveyor racks move through a dust-free, air-conditioned room where the air is charged with 85,000 volts of static electricity. As the shelves pass over the charged grids, the little tears fall away like those from the eyes of a small child pacified with a new toy. Then the shelf is smooth and deteared, ready for the thermal setting process.

PHOTO, COURTESY CELANESE PLASTICS CORP.

THE DRIVER WHO HAS ALWAYS WISHED for white wall tires on his car but has had neither the time nor the ingenuity to take care of them now has a chance of having his wish come true. Coming to his aid in the near future is an ethyl cellulose disk which gives the effect of being a part of the tire but is actually a permanent part of the wheel assembly.

At the unfortunate time when a flat occurs, the disk will not add to the confusion. Able to flex without breaking, the disk need only be pushed back into shape if it is bent. It takes little effort and the disk will look the same as before.

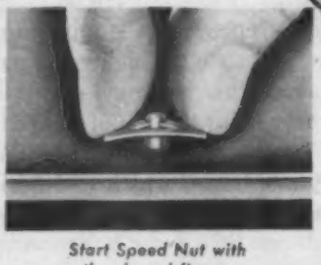
To the lazy man, the main advantage of the white disk is the ease with which it can be cleaned by merely wiping with a damp cloth.

What cars will have the new plastic white wall effect is not known but the disk will be made in sizes to fit tires of corresponding sizes.

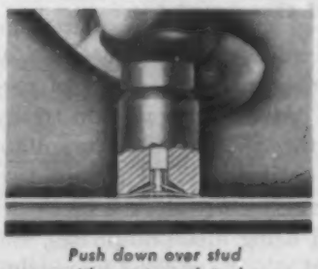
No Inserts *No Tapping* *No Machining*

For Plastic or Diecast Products with Push-on SPEED NUTS

—THE FASTER SPEED NUT WAY!



Start Speed Nut with thumb and finger.

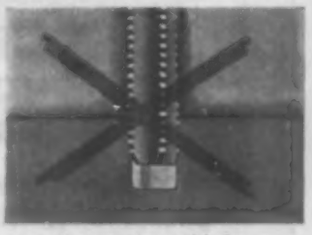


Push down over stud with countersunk tool.

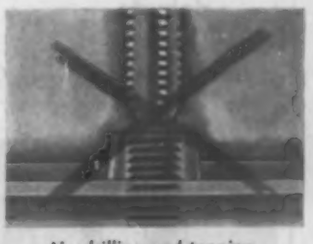
Prongs lock securely.

THESE COSTLY OPERATIONS ELIMINATED!

No more inserts in plastics.



No more tapped holes in plastics.



No drilling and tapping in die castings.

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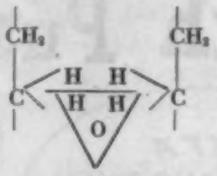
FASTEST THING IN FASTENINGS

Emulsion polymerization of ethylene

(*Continued from page 160*) its insolubility, the K-value could not be determined. At the same time the oxygen content had increased by 0.2 to 0.3 percent. It remains uncertain whether the oxygen itself effected the cross-linking by entering between two chain molecules or whether it acted by dehydrogenation and subsequent combination of chains by carbon to carbon linkage:



In the latter case the small increase in oxygen content could be explained through a small admixture of oxidation products.

Polymerization of acid-processed polymer

The hydrolyzed material used in the aforementioned cross-linking experiment had 0.68 percent hydroxyl. On the hypothesis stated before, that one end group corresponds to one molecule of polymer, the molecular weight of this product would amount to $\frac{100 \times 17}{0.68} = 2500$. This molecular weight represents the minimum value and is probably higher, because the higher oxygen content would indicate that another hydroxyl group is present, possibly ether oxygen. But this value approximately coincides as to molecular weight and K-value with that value previously mentioned which had been computed from the sulfur end group for an alkaline-processed product.

Processing of the emulsion

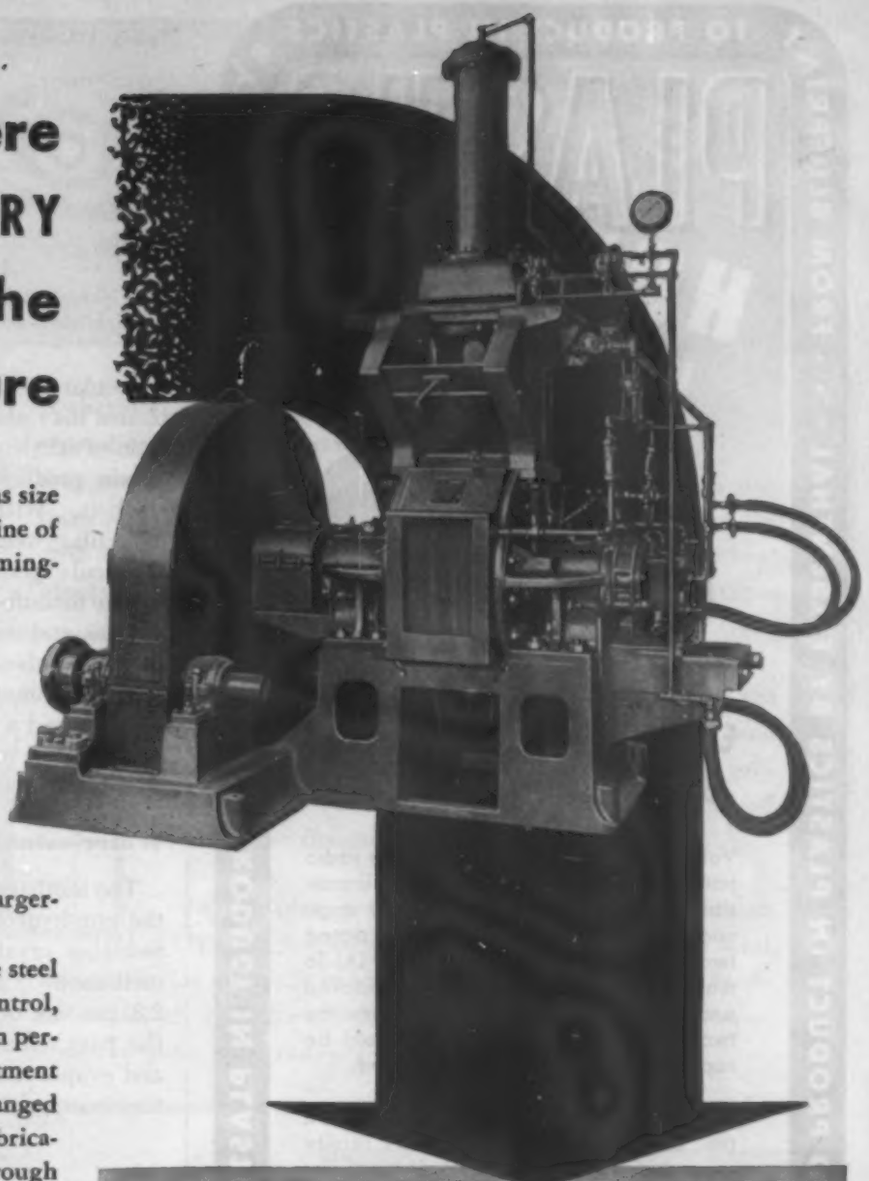
The processing of the emulsions by hydrolysis in order to get a non-hydrophilic polymer is only of preparative importance. In order to use it industrially in continuous production, the splitting off of the sulfate group must also be done continuously. There are two possibilities to achieve this:

1. In the acid method using metaphosphates, the acid content of the product may be utilized by passing the emulsion after polymerization through a tube heated to 120 to 150° C. before the pressure is released.
2. The emulsion produced by the alkaline method may also be pumped through a tube which must be heated to 160 to 170° C.

Preliminary experiments with lauryl sulfonate showed that, although a hydrolysis with dilute acids can be obtained by boiling under reflux, heating to 160 to 170° C. is necessary for alkaline hydrolysis. Discontinuous experiments for the processing of the emulsions were made according to these methods and gave good results.

In addition to chemical means, such as increasing or decreasing the amount of catalyst, one can also modify the equipment to get products of higher or lower

Here's Where THIS NEW BANBURY fits into the mixing picture



A new Banbury mixer, known as size 1-A, has been added to the well-known line of efficient processing units that Farrel-Birmingham builds for the rubber and plastics industries.

Developed originally for mixing small batches of Neoprene stock, the 1-A is identical in design with the larger Banburys and duplicates their mixing conditions and processing efficiency. It has the same built-in abrasion-resistance—the same means for control of batch uniformity as the larger-capacity units.

Important construction details include steel mixing rotors, cored for temperature control, coated with abrasion-resistant material on peripheries and fitted with end-thrust adjustment . . . cast steel mixing chamber sides arranged for heating or cooling . . . force-feed lubrication of dust stops where rotors pass through housing . . . potentiometer pyrometer with thermocouple in direct contact with batch . . . telechron-operated cycle timing device.

Write for complete details of the 1-A or any of the other Banbury mixers listed in the chart. Full information and engineering help will be supplied without obligation.

Size of Machine		B	00	1	1-A	3-A	9	11	27
Net Volume of Chamber—Cubic Inches		103	263	1193	1193	4315	11443	14940	34164
Approximate Liquid Capacity	Chamber only	½ gal.	1 gal.	5 gal.	5 gal.				
	Chamber and Neck	.8 gal.	1⅓ gal.	8½ gal.	8½ gal.				
Approximate Capacity Stiff Paste Pounds per Batch	Factor x Specific Gravity	Sp. Gr. x 2.5	Sp. Gr. x 4	Sp. Gr. x 24	Sp. Gr. x 24				
	No. of lbs.	2-4	5-10	30-60	30-60				
Approximate Capacity Rubber Stocks Pounds per Batch	Crude Rubber	2	4	24	24	85	225	300	600
	1.25 Specific Gravity Stock	3	5	27-33	27-33	100-115	230-300	340-410	700-800
	1.50 Specific Gravity Stock	4	6	32-40	32-40	120-140	310-360	400-500	850-1000
	2.00 Specific Gravity Stock	5	8	44-52	44-52	160-180	410-500	550-650	1100-1500
Motor Horsepower	Standard Single Speed	12½	15	50	50	150	200	300	500
	Standard and Double Speed	12½/25	15/30	50/100	50/100	150/300	200/400	300/600	

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Table III.—Effect of Gas : Water Ratio on K-Value of Polyethylene

Method	*Gas: water ratio*	*Polymer*	*K-value*	*Fatty alcohols soluble at 80° C. in butanol*
		%		%
Alkaline	1:2.5	79.0	25	21.0
Alkaline	1:1.0	65.0	17	35.0
Acid	1:2.5	92.1	35	7.9*

* The highest content of fatty alcohols obtained so far by the acid method was 11.8 percent.

molecular weight. The ratio of the gas and water phases may also be changed. With a 1:2.5–3 weight ratio of ethylene: water passed through hourly, one will obtain products of higher molecular weight and less alcohols. With a phase ratio of 1:1, polymers of lower molecular weight will be obtained under otherwise identical experimental conditions. But this is only true for the manufacturing method in which the pressure on the gas and water is released simultaneously through the same valve. It is noteworthy that the acid method using hexametaphosphate gives a higher K-value polymer and a lower amount of the fatty alcohols than the alkaline method when it is used with the same phase ratio.

Water-soluble substances of ethylene polymer

The methanol solution obtained in the coagulation of the non-hydrolyzed emulsion was evaporated and the resulting crystalline mass was extracted twice with methanol. The resulting product, which represented 2.8 percent of the polymer, was electrodialyzed and the part remaining in the center cell was neutralized and evaporated. Analysis gave the following percentage composition:

C 37.9 H 6.3 O 31.4 S 12.8

Theoretical for sodium octanediol monosulfate, $C_8H_{17}O_5SNa$:

C 38.6 H 6.8 O 29.6 S 12.9

Since this product was not further investigated, it cannot be stated positively that the above compound was actually present. But it seems quite likely that the compound was present because of a similar result obtained in the next experiment.

In the same manner as is shown above a sulfate was entirely isolated from another fraction. The analytical data for its sodium salt composition were found to be as follows:

C 42.42 H 7.18 O 29.1 S 10.9

These data indicate the presence of sodium decanediol monosulfate: $C_{10}H_{21}O_5SNa$:

C 43.5 H 7.6 O 29.0 S 11.6

One must assume from the course of the reaction that the basic substances of these sulfates are 1–8 and 1–10 glycols, respectively. These substances are

formed by combination of chains of 4 or 5 carbons, respectively, activated by $\frac{H_2O_2}{2}$ or OSO_3H

$$CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}\ldots\ldots\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2$$
$$\quad\quad|\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad|$$
$$\quad OH\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad O$$
$$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad|$$
$$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad SO_3H$$

This hypothesis is supported by two facts:

a. Free fatty alcohols corresponding to the left half of the molecule were found in the reaction product.

b. Alkyl sulfates corresponding to the right half were found, as already indicated.

The aqueous methanol mother liquor obtained upon coagulation of the hydrolyzed emulsion was neutralized and evaporated. The resulting crystalline paste was extracted with alcohol several times. The residue remaining after evaporation of the alcohol was extracted once more and the mother liquor again evaporated. There remained after cooling 5 grams of yellow crystals of lard-like consistency. These are soluble in water and alcohol, insoluble in ether. The 5 grams was isolated from 100 kg. of emulsion containing 4300 grams of polymer. This product was electrodialyzed. Analysis of the non-dialyzable material gave the following percentage composition:

C 52.81 H 8.32 O 31.6 S 4.9

Analysis of the product in the anodic cell:

C 33.09 H 6.61 O 44.8 S 15.0

Apparently some sulfonic acids are present which, although they are very water-soluble, withstood hydrolysis. But these sulfonic acids are not active in lowering surface tension. They were not investigated further since they are without influence on the reaction.

Investigation of the fatty alcohols

As previously explained, the fatty alcohols occur in two forms—as free fatty alcohols which are suspended as such in the emulsion and can be separated by steam distillation, and as non-volatile sulfates. In the latter group are sulfates of those alcohols which occur free.

Free fatty alcohols—These alcohols were absorbed from the distillate waters onto activated carbon, the adsorbate dried, and the free alcohols extracted with ethyl alcohol. In the case of alkaline polymerization, the main product obtained was an alcohol with the following properties: boiling point 193 to 196° C.; unsaturated; decolorizes bromine and permanganate; pleasant odor, index of refraction, 1.4364. Analysis:

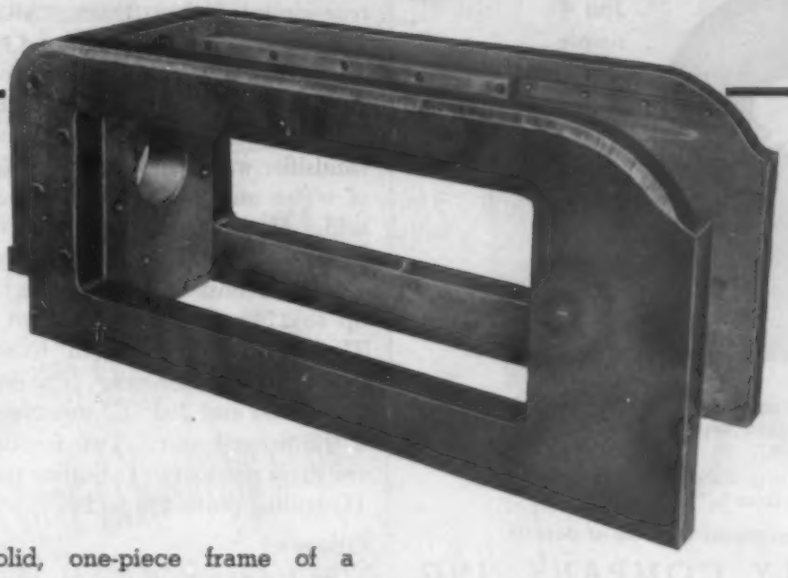
C 76.71 H 12.91 O 10.4

Theoretical for a decenol, $C_{10}H_{20}O$:

C 79.9 H 12.8 O 10.25

This alcohol has not yet been further characterized;

WHY DEMATTIA INJECTION MACHINES GIVE MORE THAN 400 TONS PRESSURE



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lack of material prevented further determinations.

Fatty alcohols from sulfates suspended in the emulsion—From an alkaline-processed batch composed of 100 liters water, 1.35 kg. potassium persulfate and 560 kg. potassium hydroxide, 80 kg. of emulsion containing 3600 grams of polymer was obtained and precipitated with 40 kg. of methanol. The coagulate was redissolved and reprecipitated three times. All the water and methanol liquors were collected and evaporated. The residue was extracted with methanol. After evaporation, 460 grams of water- and methanol-soluble sulfate was obtained as a salt. Three hundred grams of this emulsifier was hydrolyzed by boiling 5 hr. with 900 $cm.^3$ of water and 200 grams of concentrated hydrochloric acid. Hydrolyzed product was extracted with ether.

After evaporation of the ether, 71 grams of oil was obtained, consisting of alcohols. This distills at 3 mm. up to 220° C. with 29 percent remaining as residue. The part distilling up to 73° C. at 3 mm. was redistilled under normal pressure. The part then distilling between 156 and 200° C. was repeatedly fractionated in a spiral condenser. Two fractions were separated as the main products: I) Boiling point 157 to 158° C. and II) boiling point 195 to 196° C. Analysis:

Observed for I:	C 70.8	H 13.42	O 15.9	OH 16.7
Theoretical for hexyl alcohol:	C 70.6	H 13.7	O 15.7	OH 16.7
Observed for II:	C 73.69	H 13.76	O 12.3	OH 13.1
Theoretical for octyl alcohol:	C 73.9	H 13.8	O 12.3	OH 13.1

The total water-soluble alcohol fraction was 19.7 percent steam-distillable and 80.3 percent non-steam-distillable. Fractional distillation of the steam-distillable alcohols from the sulfates; original weight 13 grams:

Fractions	*Boiling point at 760 mm.*	*Amount*
	° C.	*grams*
I	Initial heating up to 160	1.0
II	160 to 180	4.6
III	180 to 200	5.2
IV	200 to 230	1.8
Residue	.....	0.4

Fractional distillation of the non-steam-distillable alcohols from the sulfates; original weight 114 grams:

Fraction	*Boiling point*	*Amount*
	° C.	*grams*
I	Up to 130/4 mm.	11.4
II	130 to 160/4 mm.	18.4
III	160 to 180/4 mm.	19.3
IV	176 to 197/1 mm.	5.3
V	197 to 220/1 mm.	10.9
VI	220 to 230/1 mm.	3.3
Residue	.....	34.0
In CO_2 condenser	.....	10.0

In another experiment with the same composition the

amount of alcohols dissolved in water as sulfates amounted to 3.2 percent of the polymer. The alcohols distilling above 130 to 165° C. at 1 mm. were crystalline. It is strange that the lowest alcohol found so far corresponds to an ethylene polymerization degree of 3, i.e., hexanol. No butanol could be found in spite of numerous analyses of various alcohol samples. Trimerization (and higher stages) seems to be more favorable among the low polymers than dimerization.

The iodine number of the foregoing fatty alcohol fractions varies between 30 and 40. The individual unsaturated fatty alcohols were not isolated.

Sulfonic acids—During hydrolysis of the solids obtained from the mother liquor of the coagulated non-hydrolyzed emulsions, a new chemical group was discovered—namely, true sulfonic acids. The acid liquor from the hydrolysis is treated with salt and the fatty alcohols extracted with ether.

The sulfonic acids form a brown oil layer between the salt solution and the ether. Since they have true C-S bonds, they were not split during hydrolysis. Their proportion is very small and amounts to only 0.15 to 0.25 percent of the polymer, as was determined from two normal experiments made according to the alkaline process. They were determined as sodium salts. These sulfonic acids are surface-active and form a foam in aqueous solution. In comparison with the amount of fatty alcohols (as reported in the following paragraph) it becomes evident that the average amount of sulfates is more than 90 to 150 times larger than that of the sulfonic acids.[5]

Extraction of the emulsion alcohols—A batch was prepared according to the usual alkaline process and 4.2 kg. of total polymer was obtained by acid hydrolysis of 50 kg. of the emulsion. After extraction with boiling butanol, cooling to 100° C., and separation of the solution, 695 grams of crude alcohol was obtained by distilling off the butanol and repeated purification with ether. This is 16.5 percent, based on the amount of polymer. For normal batches prepared according to the alkaline method, the fatty alcohol content is 22.7 percent, based on the average of five large-scale experiments. As has been partly explained before, this percentage can be considerably increased, for example, by increasing the ratio of the phases, by a higher concentration of the catalyst as well as by raising the temperature. Or it can be decreased to 7 percent or less, for instance, through acid polymerization, reduction in the amount of catalyst, decrease in temperature or increase of the ratio of the phases.

When butanol is removed by distillation, part of the lower alcohols are lost with it. This part was not taken into consideration in the aforementioned yield.

The crude alcohol fraction (695 grams) was a vaseline-like mass of pleasant odor.[6] It was subjected to fractional distillation and the average molecular weight of each fraction was determined by the acetyl saponi-

[5] Based on the alkyl group, the ratio is even more in favor of the alkyl sulfates, because in this case the free fatty alcohols are compared in weight with the alkyl sulfonates.

[6] These unrefined products could be used as they are as an ointment base, as substitutes for vaseline and lanolin, and similar purposes.

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Table IV.—Molecular Weights of Alcohol Fractions

Fraction	*Boiling point*	*Pressure*	*Amount*	*Molecular weight, average*	*Remarks*
	° *C.*	*mm.*	%		
1	Up to 64	760	6.4	...	Residual ether
2	95 to 115	3	5.5	196	Liquid
3	115 to 145	3	9.8	216	Liquid
4	145 to 173	3	8.1	235	Crystalline
5	173 to 225	3	19.3	257	Crystalline
6	225 to 270	3	12.5	297	Crystalline
7	270 to 285	3	2.6	387	Crystalline
Residue	.....	...	31.5	...	.....
Condensate in condenser	.....	...	2.6	...	.....
Loss	.....	...	1.7	...	.....

fication number. The results are presented in Table IV that appears above.

Fraction 5 of Table IV was subdivided into two fractions with the following boiling points at 2 mm.:

5*A*: 167 to 190° C.
5*B*: 190 to 215° C.

Fraction 5*A* was recrystallized several times from ethyl acetate and yielded a snow-white crystalline substance with a melting point of 63 to 64°C. and the following analysis:

C 80.35 H 14.36 O 5.4 OH 5.6 m. p. 63 to 64° C.

Theoretical for eicosanol or arachic alcohol $C_{20}H_{41}OH$:

C 80.50 H 14.1 O 5.4 OH 5.7 m. p. 65° C.

Fraction 5*B* also gave an alcohol of melting point 70 to 71° C. by recrystallization from ethyl acetate, but its analysis showed that it was not yet a homogeneous substance. Nevertheless, the determination of the molecular weight showed that direct distillation of the crude alcohol will make available fatty alcohols up to C_{26}. Even higher fractions can be obtained if the crude alcohols are not immediately distilled but are further separated through recrystallization and then distilled.

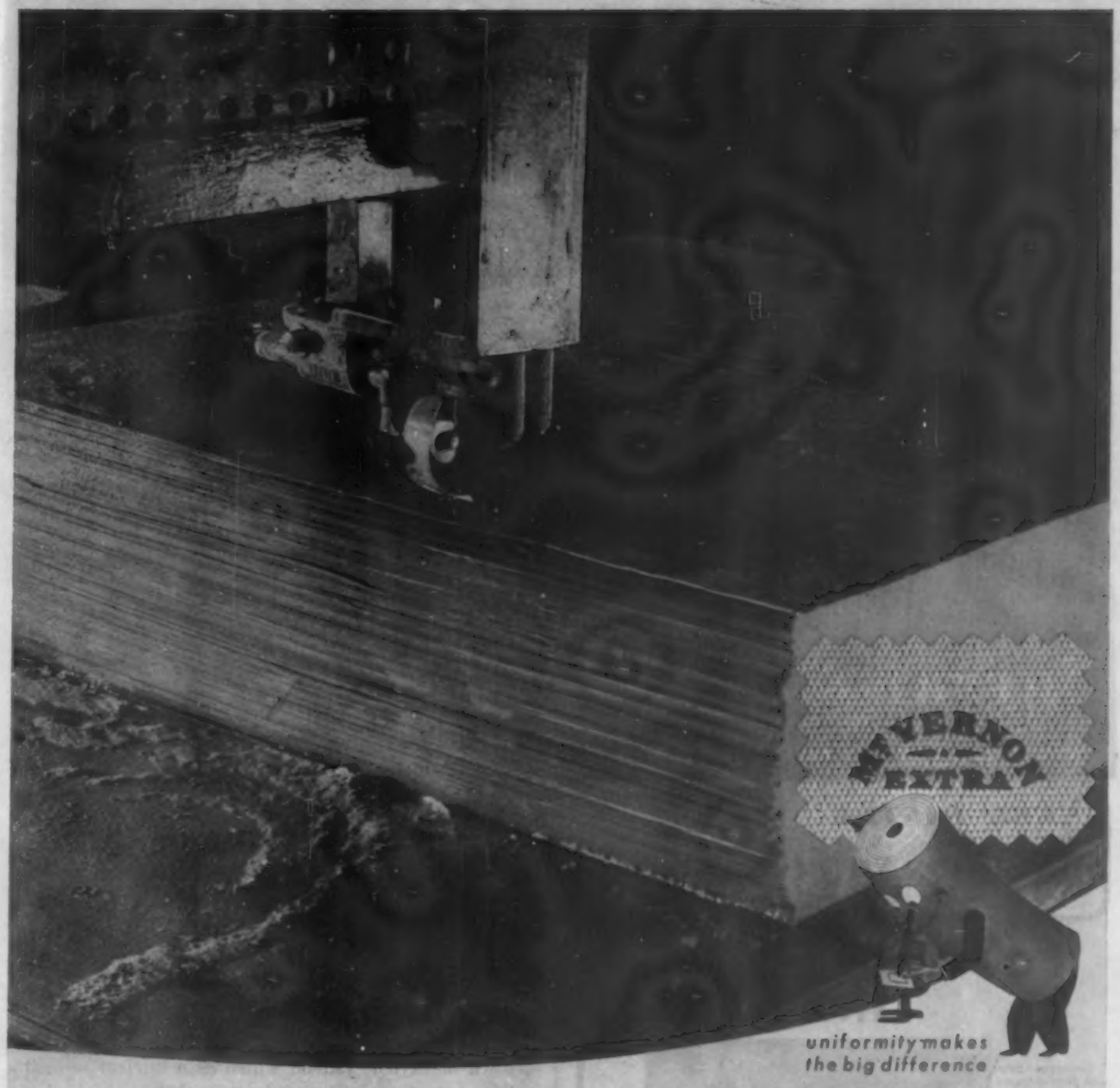
Origin of the free alcohols

The formation of free fatty alcohols during polymerization is a very interesting reaction. It might be possible to get, through it, an insight into the polymerization mechanism and thus lead to an increase in the degree of polymerization and to direct production of sulfur-free polymers. The following possibilities can be considered theoretically:

1. Hydration, e.g., of triethylene:

$$\begin{array}{l} CH_2-CH_2-CH_2-CH_2-CH_2-CH_2 \\ \cdot \qquad\qquad\qquad\qquad\qquad\qquad \cdot \\ \cdot \qquad\qquad\qquad\qquad\qquad\qquad \cdot \\ \cdot \qquad\qquad\qquad\qquad\qquad\qquad \cdot \\ OH \qquad\qquad\qquad\qquad\qquad\qquad H \end{array}$$

A direct water addition of this kind could hardly be



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considered probable since ethylene according to our present knowledge must be activated by another molecule which adds itself to it. But, on the other hand, an activated nuclear molecule is at hand when a hydroxyl group is split off from the primary addition product of persulfate and ethylene. This hydroxyl group can add itself to another ethylene molecule and would in this way start the polymerization. In case this reaction takes place, two active centers would be formed from one molecule of Caro's acid which will start two polymerization chains:

a. The sulfate-containing radical.
b. The hydroxyl-containing radical.

The chain reaction will be broken by a hydrogen atom which must be furnished by another reaction. Nascent hydrogen peroxide can be assumed to provide the hydrogen; hydrogen peroxide is formed from two hydroxyl groups which split off in the aforementioned way from the addition product of persulfate and ethylene.

2. From this hypothesis results the possibility of a coupled reaction:

$$2\,OH \rightarrow H_2O_2 \rightarrow$$
$$2\,H + O_2\;2\,H + 2\,OH + 2 - R - \rightarrow 2 - R -$$
$$\vdots \quad \vdots$$
$$OH \quad H$$

3. From the continuity of the boiling points as well as from the molecular weight and analytical data, it is evident that there must be also fatty alcohols of uneven numbers. These can only be formed through splitting of the ethylene molecule; one such splitting has been clearly demonstrated by the presence of formaldehyde. Unevenly numbered alcohols can develop in two ways:

a. Formaldehyde enters an alkyl group forming a methylol group.
b. Half-side oxidation of ethylene

$$H_2C = CH_2O$$

forms a methylene radical which as a nuclear radical itself can start one or two polymeric chains which may be said to be similar to the radical-forming tetraphenyl-succin *o*-nitrile.

4. The simplest explanation for the presence of fatty alcohols would be the hydrolytic splitting of the primarily formed sulfate under the influence of the alkali. But this formation is actually very improbable since in trial tests that have been made a similar splitting under the same reaction conditions could not be achieved.

Ethylene polymerization by end-groups

In view of the possibilities which have been discussed so far for the formation of polyethylenes with definite end groups, one comes to the conclusion that every reactive nucleus can also serve to end the reaction. In this case bifunctional derivatives would be formed. The chain reaction can furthermore be broken by

hydrogen. There are the eleven following possibilities:

Nucleus activator	*Chain terminator*	*Proved*
R OSO_3H	H	Yes
R OSO_3H	OH	Yes
R OSO_3H	R OSO_3H	No
R OH	H	Yes
R OH	R OH	Possibly
H	H	No

The last possibility would be especially interesting and important since an activated hydrogen atom (except if activated by persulfate) could act as catalyst, i.e., as a nuclear molecule. In this case, no heterogeneous atom would enter the molecule; the hydrogen atom as nucleus and terminator of the chain reaction would lead to pure paraffins. We intend to conduct more experiments to determine whether it is possible to find a form of the hydrogen atom which would accelerate polymerization.

Miscellaneous observations

When the process was carried out with ammonia, ammonium persulfate or other ammonium salts, it was found that amines were formed, apparently fatty amines as well as cyclic bases, which were found in the distillation condensate. The investigation of this reaction was postponed in favor of the main problem.

Emulsion polymers were also obtained with gaseous oxygen as catalyst. But even at 1000 atmospheres only low polymeric products resulted. Work on this reaction was then abandoned but will be taken up again later.

During copolymerization experiments it was observed that ethylene is very sensitive to the presence of other monomers. Butadiene and styrene prevent the polymerization of ethylene; only with *uns*-dichloroethylene was an unsatisfactory copolymer obtained.

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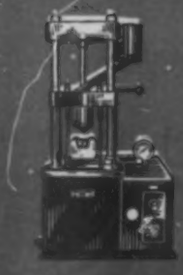
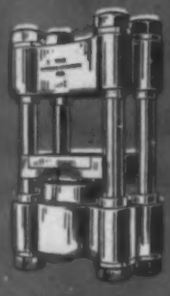
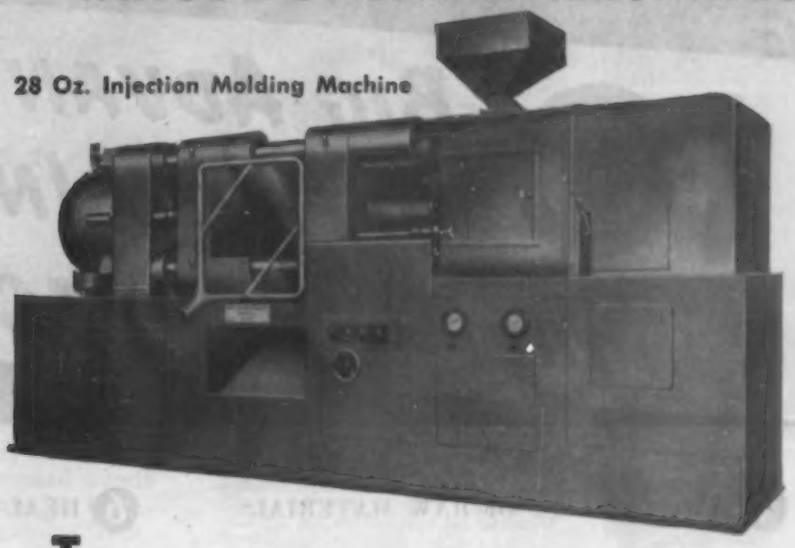


1 Oz. Injection Molding Machine



Hobbing Press

28 Oz. Injection Molding Machine



THE new line of Watson-Stillman Injection Molding Machines has been particularly designed to meet the latest demand for large, extra deep parts.

More flexibility—a higher degree of control—with the same rugged, dependable Watson-Stillman quality construction—these are the reasons why more and more molders are making Watson-Stillman their "Headquarters".

Watson-Stillman builds the most complete line of Hydraulic Molding Equipment available. This equipment includes Compression, Transfer Molding, Preform Machines for Transfer Molding, Vertical and Horizontal Injection Machines, all in a wide range of capacities. In addition, Watson-Stillman also manufactures a complete line of Hobbing Presses in sizes from 200 to 3000 Tons.

Let W-S Plastics Engineers go over your particular molding problem with you.

Write or call—Watson-Stillman Co., Roselle, N. J.

1280

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HYDRAULIC MACHINERY DIVISION

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ROSELLE, NEW JERSEY

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MANUFACTURERS OF THE MOST COMPLETE LINE OF HYDRAULIC MACHINERY

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1. AVAILABILITY OF RAW MATERIALS
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8. GROWING CONSUMER MARKETS
9. INCREASING INDUSTRIAL DEVELOPMENT
10. FAVORABLE DISTRIBUTION FACILITIES*

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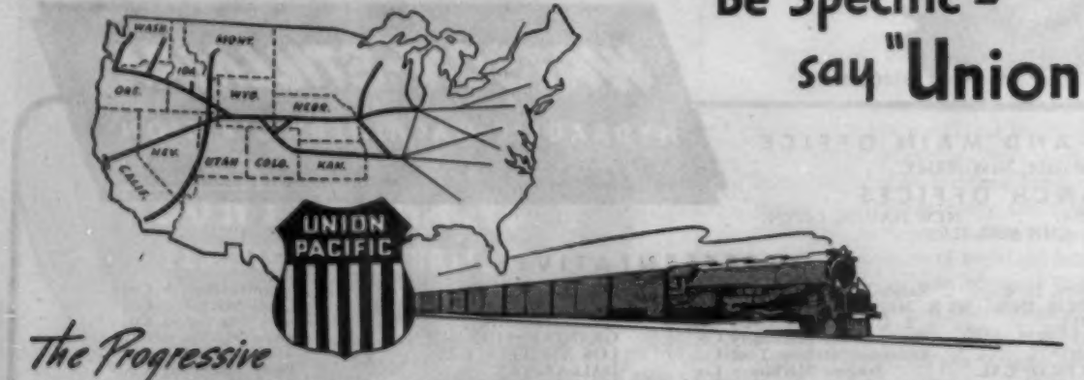
Union Pacific—the Strategic Middle Route—unites the East with the Mid-West, Intermountain and Pacific Coast states.

It has facilities and equipment designed to meet industry's heaviest demands. Trained traffic men offer a helpful, cooperative service to all shippers.

For information regarding western industrial sites, write W. H. HULSIZER, General Manager of Properties, Department 101, Union Pacific Railroad, Omaha 2, Nebraska.



be Specific – say "Union Pacific"

The Progressive

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The Strategic Middle Route

INDEPENDENT INVESTIGATOR FINDS

Phillips Screws pay Pullman

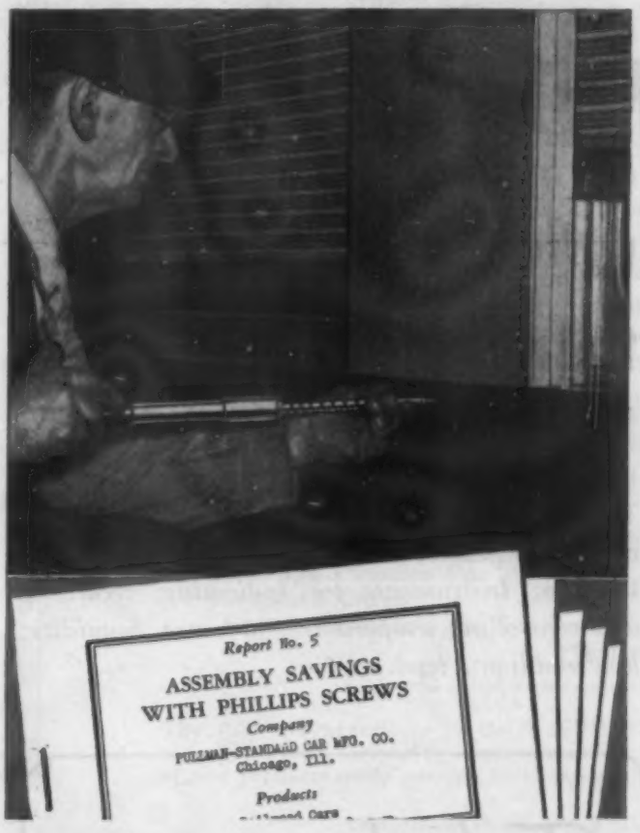
big money savings for hundreds of driver skids eliminated! Hold better ... look better!

Investigators from James O. Peck Co., industrial research authorities, are visiting a number of representative plants to get authentic FACTS on assembly saving. Get the "INSIDE STORY" of successful assembly practice — read his fact-filled reports!

"When we used slotted screws, we had plenty of trouble with drivers slipping and puncturing the pressed wood panels we use by the thousand for inside trim," a Pullman assembly executive told the investigator. "This meant removing and discarding the panel, replacing and hand-painting – to the tune of several dollars per skid. Phillips Screws ended driver skids. But that's only one way they pay off.

"Where the heads show in the finish they look better. They don't have to be lined up, like slotted screws, which means they can be set up tighter to resist vibration.

"Railroads like them because they can't be loosened by passengers with coins or nail files like slotted screws – to tear clothes and cause damage claims."



REPORT TELLS MORE PHILLIPS ADVANTAGES

The investigator asked Pullman the same questions you would ask about assembly methods. The report tells you the complete, revealing answers.

It's one of a series of assembly studies covering all types of products – metal, plastics, wood – being made to show how the many Phillips Screw advantages add up big savings you can make in your assemblies.

The reports now ready – and more to come – comprise a practical manual of modern assembly methods – never-before-printed information – inside facts you'd pay good money to get – and you can have them, now, FREE!

PACKED WITH IDEAS FOR SAVINGS IN YOUR ASSEMBLIES

Find out how industry's top-flight assemblers licked problems like your own! Get these reports! Don't wait – fill out and mail the coupon TODAY!

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Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

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Please send me the reports on Assembly Savings with Phillips Screws

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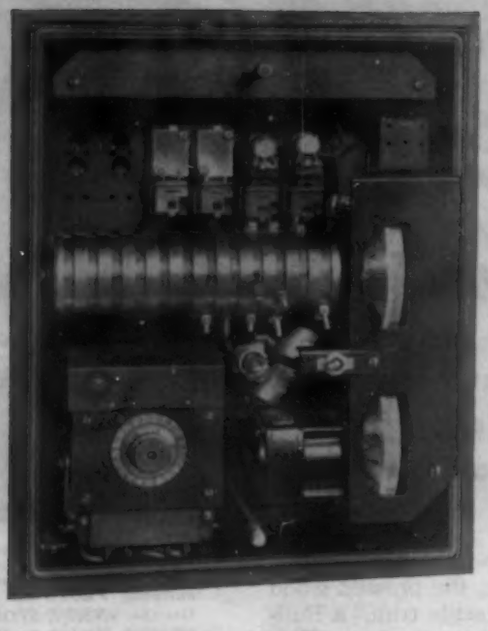

How to have

SPLIT-SECOND TIMING

in molding thin-section products and fast-setting thermoplastics!

ARE you turning out articles requiring short molding periods, such as thin-section products or fast-setting thermoplastics? We've worked out a system that may be just what you need!

The idea is to use a Taylor Flex-O-Timer and a 30 RPM motor to drive the drum on which the trip clamps are set. This way it's easy to run short cycles with proper co-ordination of all auxiliary functions. In fact you can have cycles as short as 13 seconds. And on the other hand, if your Flex-O-Timer is equipped with the small auxiliary timer (as illustrated) you can easily prolong the molding period to any normal requirement.

Whatever your problem—whether you need simple temperature or pressure control or complete automatic control of the whole molding operation including pressure, temperature, and time—we'd like to go to work for you. Call your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

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VIRGIL E. MEHARG – Bakelite Corporation

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. . . and the Hyatt Award Committee for its recognition of the outstanding importance of high frequency heating in the advancement of the plastics industry.

"High frequency heating differs from all other types of heating in that the heat is generated in the material by placing the material in a high frequency electric field. Under the influence of this field the molecules of a non-conductor, such as a plastic, become oriented, and, when the electrical field is reversed, the molecules rotate. When the reversal occurs many millions or more times a second, friction occurs among the adjacent molecules, with the resultant formation of heat" . . . *the Hyatt Award Brochure.*

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*Our apologies to the scores of valued customers whose names are omitted.

The skill and experience of the THERMATRON organization are available to forward-looking manufacturers interested in improvements on present production processes – and in the vast field of new products made possible by electronic high frequency heating.

"Electronic Heating and Sealing with the Thermatron" – our new brochure – will be forwarded to executives on request.

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Chicago Sales Agent: ZEPHYR ELECTRONICS, 32 W. Randolph Street, Chicago, Ill.

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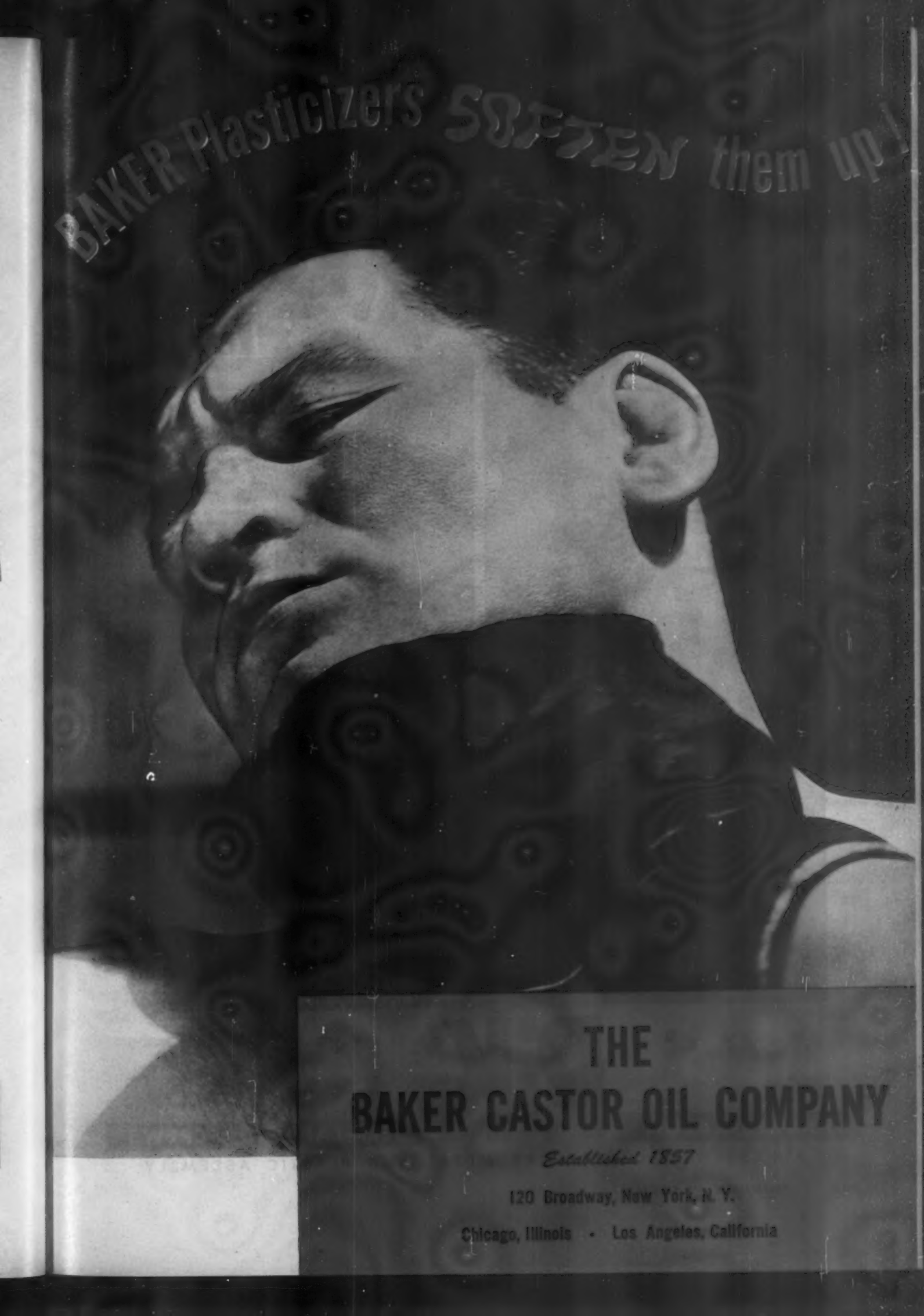

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BAKER CASTOR OIL COMPANY

Established 1857

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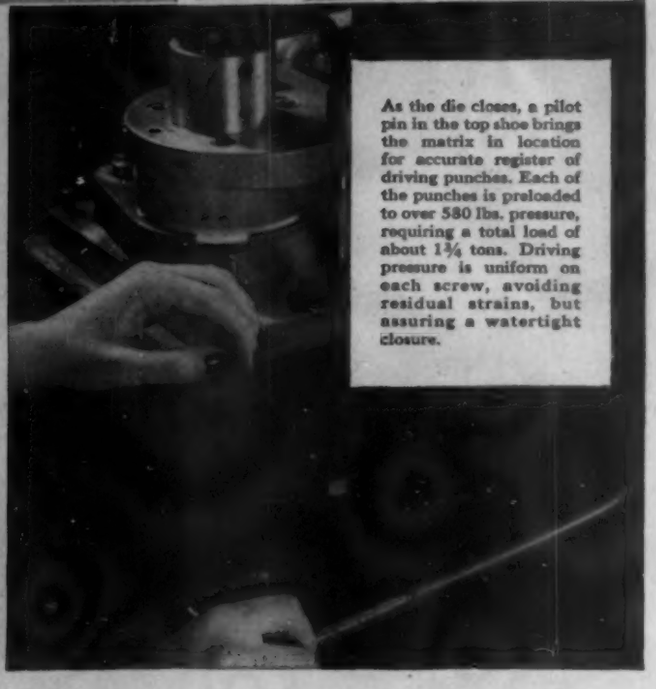
Chicago, Illinois • Los Angeles, California

6 P-K SCREWS DRIVEN simultaneously to assemble case IN ONE OPERATION

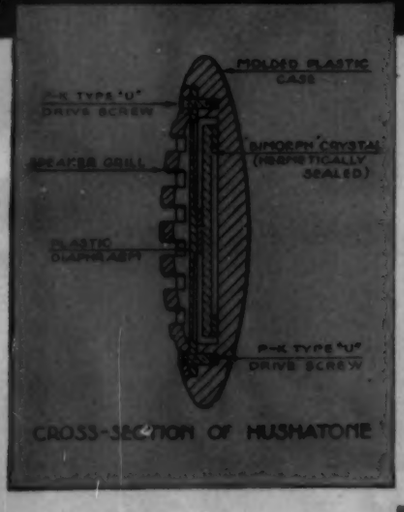
The Brush Development Company avoids expense of brass inserts and troublesome tapping in blind holes — speeds assembly of Hushatone miniature speakers for hospital use.

COMMON SENSE ASSEMBLY ENGINEERING

Six No. 4 x ⅜" P-K Type "U" Drive Screws are used to fasten together the molded Plaskon case, diaphragm, and grille. To speed assembly, and to insure uniform pressure for closure on each screw, this ingenious two pillar die set was designed. The "swing gate" simplifies loading and unloading, promotes safety.



As the die closes, a pilot pin in the top shoe brings the matrix in location for accurate register of driving punches. Each of the punches is preloaded to over 580 lbs. pressure, requiring a total load of about 1¾ tons. Driving pressure is uniform on each screw, avoiding residual strains, but assuring a watertight closure.



CROSS-SECTION OF HUSHATONE

Recognizing the obvious cost advantages of P-K Type "U" Drive Screws over inserts or tapping for machine screws, The Brush Development Co. engineers came up with an idea for simultaneous driving that multiplied time saving. It also met tricky requirements for uniform holding pressure to insure a lasting, liquid-proof seal that would permit sterilization. They report "no failures due to leakage or loose screws".

This application is one of thousands in which America's best assembly engineers have used the P-K "short cut" fastening method to save up to 50% in fastening time and labor, and reduce spoilage. It's plain *common sense* to find out if your assembly is one of the 7 out of 10 in which P-K Screws can be used to similar advantage.

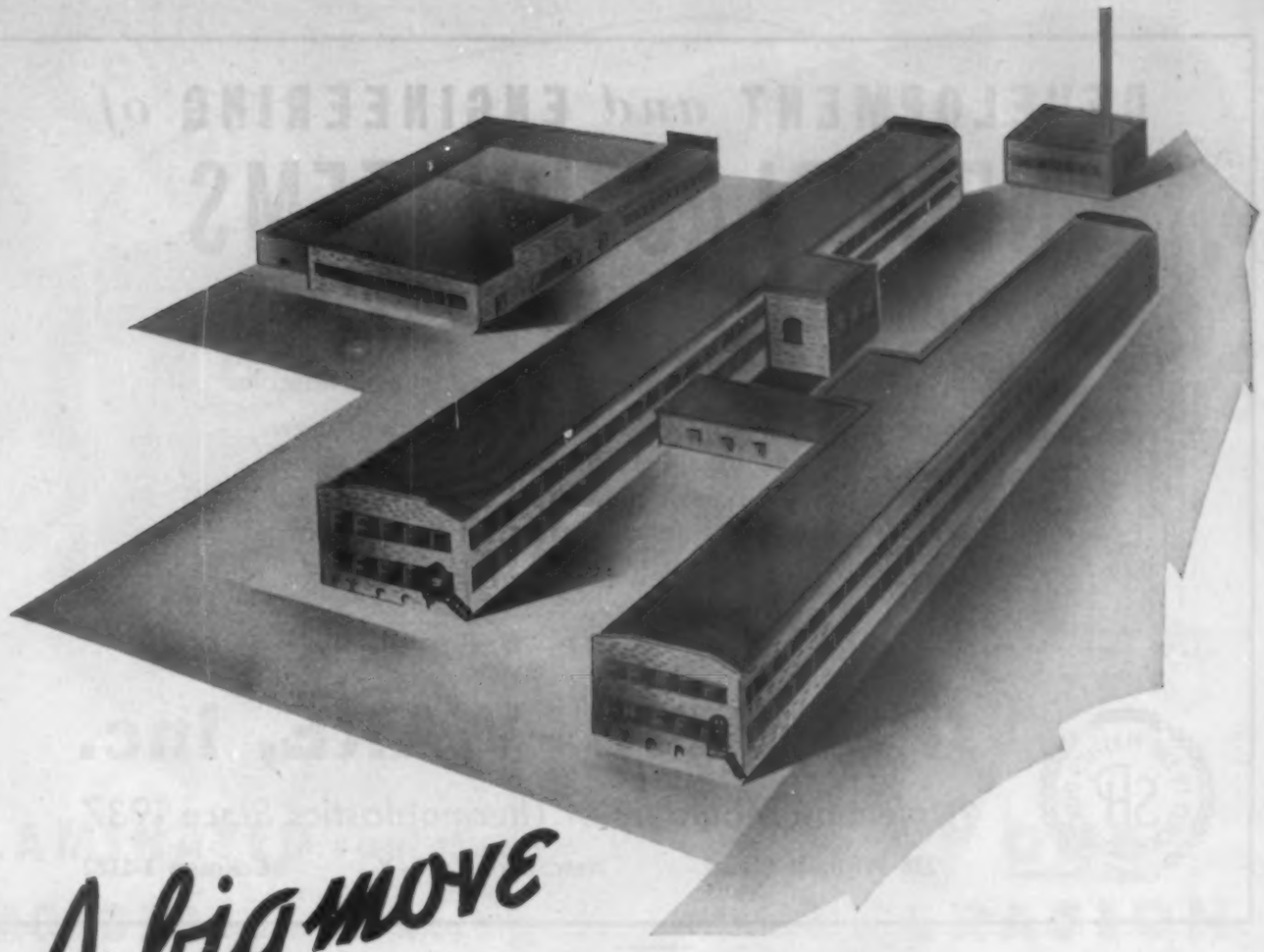
A P-K Assembly Engineer will call at your request. Or, mail assembly details for recommendations. It's a sensible first step toward making the savings you've been missing. Parker-Kalon Corp., 200 Varick St., New York 14.

Sold Only Through Accredited Distributors

P-K

PARKER-KALON **SELF-TAPPING SCREWS**

A FASTENING FOR EVERY METAL AND PLASTIC ASSEMBLY



A big move in your direction . . .

To meet the ever-increasing demand for a larger variety of plastics fabrications, we are pleased to announce that we have acquired several modern, conveyor-equipped, brick buildings, with triple our former floor space and capacity. With a proportional increase in personnel and modern equipment, we are now in a position to render a service better than ever and second to none. Added to an already established record for outstanding design and quality production, these new facilities will afford more prompt deliveries and a greater diversity of Plastic Turning fabrications. We hope that you will take full advantage of this expansion.

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Turning Co. Inc.
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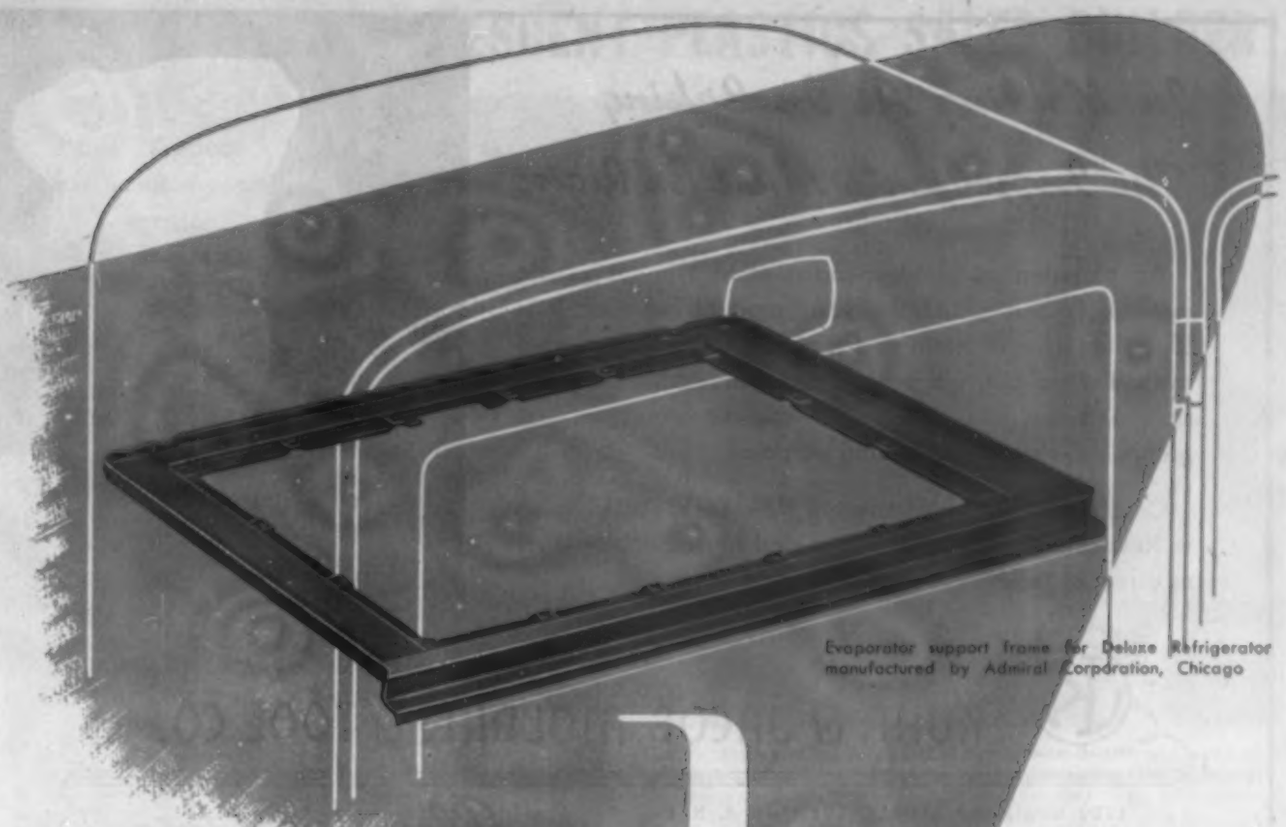


Evaporator support frame for Deluxe Refrigerator manufactured by Admiral Corporation, Chicago

LAMINATED FOR STRENGTH
MOLDED FOR ECONOMY
} IN ONE OPERATION

How would *you* produce the complicated shape pictured here? By which process and from what material?

This problem was neatly solved at MPC with a paper-base phenolic, laminated and molded in one operation. A simple punching operation plus a sprayed and baked white enamel finish complete the production of this part. It is dimensionally stable and has ample strength and rigidity. These characteristics are not affected by temperatures as high as 275° F. in the enamel baking oven . . . or as low as —5° F. encountered during actual use in the refrigerator.

In this case, another production problem was solved by ingeniously applying the remarkable properties of plastics. Such applications call for experience . . . imagination . . . and production "know-how." That is what we, at MPC, offer you . . . plus the most advanced equipment for compression, transfer and injection molding. Submit your plastics product or problem to MOLDED PRODUCTS CORPORATION, 4533 W. Harrison St., Chicago 24, Illinois.

PLASTICS DIVISION
MOLDED PRODUCTS
CORPORATION

ANOTHER PHOSPHORESCENT PLASTICS SALES BUILDER!

"Eye" Appeal
• Adds Sales Appeal

Luminescent plastic products have extra "eye" appeal that adds to their sales appeal—particularly such practical items as the "luminous" switch and electric outlet plates shown in the store view (right).

(Left) closeup of display card, showing visible light appearance and with plates "glowing" in the dark. Molded by Gits Molding Co., of phosphorescent polystyrene (Lustron) from Monsanto Chemical Company.

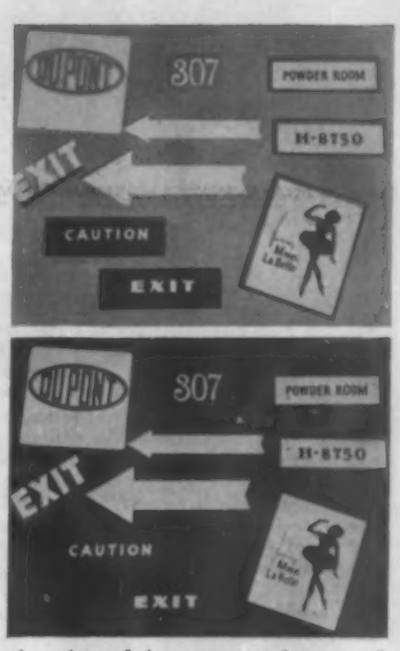
The "Glow" is Injected with Horse Head* Luminescent Pigments

LUMINESCENT plastics, using Horse Head Luminescent Pigments, offer many opportunities for new, commercial applications. The complete line of switch and electric outlet plates, made of phosphorescent ("luminous") plastics, is but one such application. Other interesting, practical uses include signs (directional, informative, exit, fire, danger, caution, etc.); articles that are easy to find in the dark (clock dials, cord pulls, door knobs and lock plates, house numbers, lamps, marking tapes, etc.); toys; games; and novelties. In the decorative, display, and advertising fields, the fluorescent as well as the phosphorescent types of Horse Head Luminescent Pigments provide many interesting and practical effects under conditions of darkness, or semi-darkness.

Why not review your applications to see where Horse Head Luminescent Pigments can add extra sales value, or create new markets? Our technical staff will be glad to discuss it with you.

*Reg. U. S. Pat. Off.

If you are in doubt where to obtain the right type of luminescent plastic molding granules, powders, sheets or cast films, write us for further information. (The New Jersey Zinc Company does not manufacture plastics—we supply Horse Head Luminescent Pigments used by plastic manufacturers.)



A variety of signs, arrow pointers, and a display card, made of phosphorescent and fluorescent methacrylate (Lucite) from du Pont.

HORSE HEAD PRODUCTS
New Jersey Zinc

THE NEW JERSEY ZINC CO.
160 Front Street, New York 7, N. Y.

Products Distributed by THE NEW JERSEY ZINC SALES COMPANY •
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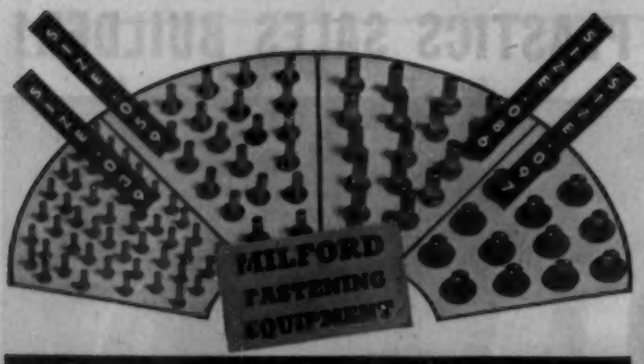
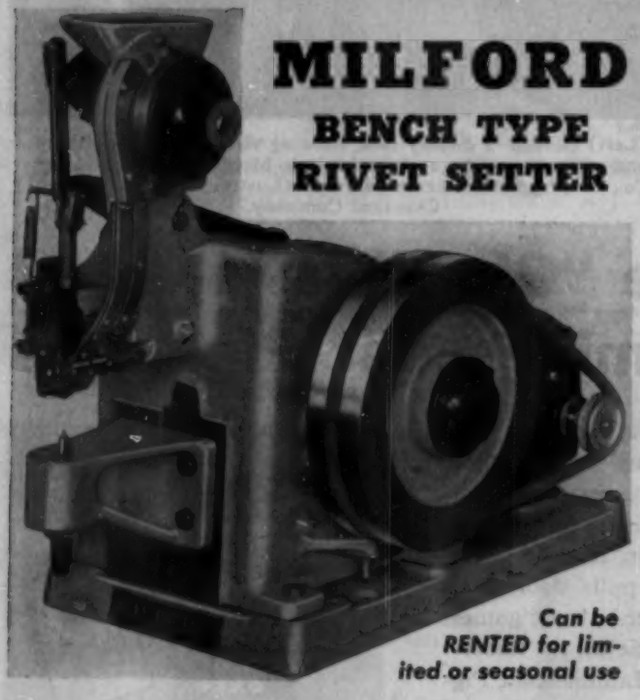


Sets 60 Rivets PER MINUTE

in Metal, Wood, Fabric, Plastic or any combination of the four



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Can be RENTED for limited or seasonal use

Whether your assemblies are of metal, wood, fabric or plastic parts —or any combination of the four—here is fastening speed for you. To cut costs. To save time. With every fastening perfect. Never to come apart. What an extravagance now to set rivets by hand!

The Milford Bench Type Rivet Setter, versatile, powerful, precision-made, is the Little Giant of the Milford line of rivet setters. The others are all floor models, single and double spindle, accepting rivets up to ¼" x 2".

In fasteners and fastenings, Milford's "know-how" is vast. Make use of it—it's FREE. Whether your product is in or out of the drawing board stage, get Milford's ideas on cost-cutting, time-saving fasteners: semi-tubular rivets or special, small metal parts or fasteners.

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867 Bridgeport Ave. MILFORD, CONN.
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Inquiries may also be addressed to our subsidiary:
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Canastota, N. Y.

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Plastimold, INC.
ATTLEBORO, MASS.

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● Metasap Stearates help meet the demand for better lubrication needed by today's plastics industry with its intricate mold design and greater precision in the manufacture of molded articles Metasap products permit operations at lower pressures —they penetrate to the surface of the compound to give a clean-cut finish—they eliminate the need of after-treatments involving buffing operations. Result—improved internal lubrication and a clearer molding job at worth-while savings. For complete information write,

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of Aluminum · Calcium · Lead · Zinc

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NOSCO IS QUALIFIED AND CAN HELP YOU.

Write today.

NOSCO Plastics

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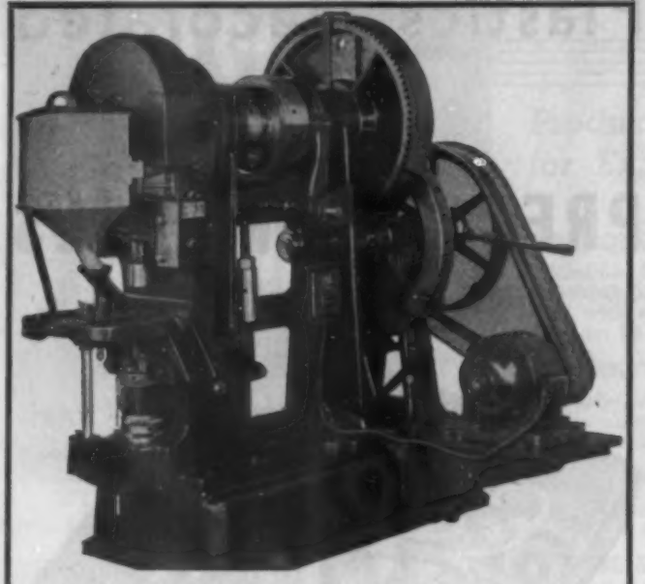

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FOR SALE—1—30" x 60" Press, 6 Posts, 2—25" dia. rams; 1—12" x 12" Press 7" Ram, Steel Heated Platens and Hand Pump attached; 1—24" x 24" Adamson, 10" ram, 2-opening Hydraulic Press; 1—24" x 24" Farrell, 10" ram, 2-opening Hydraulic Press; 1—30" x 30" D & B, 2-open, steel heated Platens 12" ram; 2—La Pointe Hydraulic Pumps, 150 G.P.M.—2000 lb. pressure direct motor driven to 125 HP AC motors; 1—Housatonic #2 Tuber 3 1/4" Dia. worm; 1—French Oil Hydropneumatic Accumulator; 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Platens; 6—Hydraulic Presses, 20" x 20", 12" x 14"; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 1545, Modern Plastics.

PLAN FOR TOMORROW for Post-War. Pioneer firm in plastics trade offers services. Write what you can offer now or later on. P. M. Wishkhoor & Co., 82 Jangi Shiwala, Amritsar (India). Estd. 1910—Cable Wisco. Head Office Bombay 2.

WANTED: Organic Chemist familiar with resin bonded grinding wheels to take charge of development and manufacture in established company. Give complete history in reply. Reply Box 1509, Modern Plastics.

LUCITE-PLEXIGLAS sheet scrap for regrinding, clean, unmasked, not contaminated, any size all quantities wanted. Reply Box 1582, Modern Plastics.

FOR SALE—Two new #4 Racine pumps var. vol. aut. gove.—one #8862 gauge—one 1 1/4" pilot check lov-76-AK—One sequence valve—one Racine 6:1 booster—Adv. Nov. Mfg. Co.—2218 N. Park Ave., Phila. 32, Pa.—Fremont 4395.

WILL BUY used late model injection machines 4 oz. up for export. Some molders, large and small find it impossible to get materials because of the number of new molding machines. Materials will be short until 1947, then competition will be tough. Now is the time to sell. We will pay reasonable prices. Give year, model, and price when writing. Reply Box 1528, Modern Plastics.

WANTED: PLASTIC SCRAP OR REJECTS in any form, Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

AMBITIOUS YOUNG MAN with experience in injection, extrusion molding, color matching, testing, plastics research, desires position in thermoplastics molding industry. Architectural, Industrial Engineering, drafting education. Wish to establish lifetime career in experimental research or designing. Reply Box 1561, Modern Plastics.

YOUNG GRADUATE LACQUER CHEMIST wants responsible job. Excellent background; eleven years of formulation and development work on all types of surface coatings for metals, wood, plastics, etc. Conscientious, industrious. Present salary $5300. Reply Box 1562, Modern Plastics.

DEVELOPMENT ENGINEER seeks position in New York City. Chemist with diversified plastics, mechanical, electronics, accoustics, photographic, and supervisory experience. Conscientious, intelligent, energetic. Desires permanent employment. Reply to: T. C. Edwalls, Jr., 64 Sagamore Rd., Apt. A-8, Bronxville, N. Y.

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WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Ethyl Cellulose, Acrylic and Vinyl Resin material. Submit samples and details of quantities, grades, and color for our quotations. Reply Box 508, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

CANADIAN REPRESENTATION
Canadian Manufacturer's Agent desires to represent American Manufacturer of chemicals and patented compounds; plastic materials and moulded products; industrial, hardware and departmental store items. Sole rights for Province of Ontario. Reply Box 1560, Modern Plastics.

Pure Methyl Methacrylate Monomer—For Sale. $5.00 per gal., FOB Brooklyn. Montauk Chemical Co., 356 Pearl St., Bklyn., N. Y.

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Aggressive organization will act as Mfg. Rep. in accordance with your sales policy. Jobbers, Resident buyers, manufacturers or direct dealer. Contact WEST SALES COMPANY, 1521—2nd Avenue, Los Angeles. ROchester 1203.

WANTED: thermoplastic rod, round, half-round, oval sections in clear or white in 1 foot lengths or in multiples of 1 foot. Diameters of round and oval from 1/16" to 1/4"—half-round from 5/16" to 1/2". Submit samples and quote prices. Reply box 1563, Modern Plastics.

FOR SALE: (1) 20" x 42" die press $200.00. Must see to appreciate buy. (1) 60 ton double acting cylinder, 5" ram, 8' stroke, $300.00. (1) Quincy air compressor 5 x 4, water cooled, 15 H. P. V velt drive, vertical air tank 72 x 20 with compensator, $300.00. Located at Sal's Press, 375-377 Baltic Street, Brooklyn, New York.

PLASTICS CHEMIST and technician, former top executive, long diversified experience in compounding, research, production and development; seeks authoritative position either as assistant or consultant to top executive or, on development, research or patent work. Must be a highly rated concern offering pleasant and congenial conditions and surroundings. Location anywhere. Reply Box 1565, Modern Plastics.

ORGANIC CHEMIST—5 years' experience in plastics. Have the "know-how" in phenolic castings, flexible molds, plating non conductors. Desires position entailing research plus management. Can take charge of production. Have experience in setting up plant. Reply Box 1569, Modern Plastics.

WANTED by established Chemical Company expanding in the resin field, a sales representative for further development and application of a complete line of resins. Prefer a man with experience in phenolics who can organize his work and take full advantage of a complete Research Laboratory. Opportunities good. Applicant should state experience and age. Reply Box 1571, Modern Plastics.

FACTORY MANAGER—Graduate Engineer preferred. Must have expert knowledge of toolroom, hydraulics, steam, production methods and materials, with at least 5 years' experience in compression plastic molding plant, and be able to furnish references. Excellent opportunity in expanding midwestern plant. Will pay top salary. Reply Box 1576, Modern Plastics.

CUSTOM MOLDERS REPRESENTATIVE Greater New York territory, interested in connecting with plant who can anticipate tomorrow's competition today. Married, age 34. Reply Box 1577, Modern Plastics.

CREATIVE MECHANICAL ENGINEER

We have an opportunity in our Research Department for a graduate mechanical engineer who has initiative and ability to design special machinery for new products and improvement in present machines. Permanent position and work is interesting. Company substantial and growing. Knowledge of paper, plastic laminates, or coatings advantageous. Location western New York. Write us your qualifications, including education and salary expected. If application meets our requirements interview will be arranged. Correspondence treated confidentially. Reply Box 1564, Modern Plastics.

WANTED: Experienced Injection Molding Supervisor. Excellent opportunity for qualified applicant to assume complete supervision of plant in Mid-South city. Must be thoroughly familiar with all thermoplastics, molds and machinery. Furnish complete information concerning experience, qualifications, and salary expected. Reply Box 1572, Modern Plastics.

WILL BUY FOR CASH
Virgin VYNW resins and Dioctyl Phthalate. Also willing to purchase cleaned Vinyl sheeting scrap any quantity. Also will buy Calender 3 or 4 roll -48 inches or over and Mills (high-speed) 22" & 22" x 60" heavy duty. State condition, make and price. Reply Box 1566, Modern Plastics.

EXPORT COMPANY seeking from manufacturers leather imitations all colors, coated fabrics and other plastic materials for export to all continents. Representatives all over the world. Reply Box 1567, Modern Plastics.

COLOR CHEMIST—Thoroughly experienced in the pigmenting of thermosetting and thermoplastic resins, conversant with all types of pigments and dies. Wonderful opportunity, excellent working conditions for right party. Give details in first letter. All replies confidential. Reply Box 1568, Modern Plastics.

MARYLAND REPRESENTATIVE: Young man, married, college education (chemistry major) desires position as representative of reputable manufacturer in the plastic industry. Have three years sales experience (not in plastics). Own late model automobile and reside in Baltimore. Reply Box 1573, Modern Plastics.

FOR SALE: For Immediate Delivery (2) 23 x 24 100 ton capacity, (2) 14 x 14 125 ton capacity, (1) 18 x 18 150 ton capacity, self-contained pumping units available. (1) Oil gear pump, 2400 cubic inches. 1000# pressure $400.00. (3) New 75-ton double acting cylinders, 12" ram, 7" stroke $500. Sal's Press, 386-388-390 Warren Street, Brooklyn, New York.

We furnish trained, experienced personnel to companies using plastics. Write to the nearest office of Plastics Institute stating your requirements. No cost to employer or graduate. Plastics Industries Technical Institute, New York 17: 122 E. 42 St.; Chicago 1: 221 N. LaSalle St.; Los Angeles 6: 1601 So. Western Ave.

TOOLMAKER, plastic buttons. Take full charge of turning dept. Have machine shop experience. Interested in learning compression molding. Reply Box 1584, Modern Plastics.

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THE Treasury Department has published two new booklets to help you and your employees realize the utmost benefit from your Payroll Savings Plan—benefits proportioned to the extent your employees add to "take home savings" by buying and holding U. S. Savings Bonds.

"Peacetime Payroll Savings Plan" for key executives offers helpful suggestions on the conduct of the Payroll Savings Plan. In addition, it quotes leaders of Industry and Labor and their reasons for supporting the Plan.

"This Time It's For You" is for distribution to employees. It explains graphically how this convenient, easy thrift habit works. It suggest goals to save for and how much to set aside regularly in order to attain their objectives. If you have not received these two booklets, or desire additional quantities, communicate with your State Director of the Treasury Department's Savings Bond Division.

See your Payroll Savings Plan through to maintain your share in America's future. It is sound economics and a powerful force for good today—and tomorrow—as a safeguard for stability and a reserve of future purchasing power—money that is kept within your community.

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PLASTICS ENGINEER WANTED
A permanent opportunity for experienced Plastics Engineer with large New England machine tool manufacturer planning to develop the use of plastics applied to machine tool parts. Position will require vision and initiative. This engineer will be responsible for recommending applications where plastics can be used to advantage, working out the design of plastic parts, recommending materials and the making of experimental samples and models to be tested and proven. After approval and adoption, he will be responsible for the design of molds and the complete supervision of equipment and men to produce these parts. Please submit complete details of experience, education, personal history, and expected salary. Reply Box 1574, Modern Plastics.

WANTED: By an established Molding Company in the middle west, an experienced tool maker in plastic molds to take full charge of tool room. Must be capable of figuring mold costs, mold designing and lay out work. Good salary and bonus to right man willing to work for a future. State complete experience in reply. Reply Box 1575, Modern Plastics.

AVAILABLE—Brake Lining Engineer. 15 yrs.' experience passenger car and truck materials. Knowledge of formulation, equipment, and production problems. Reply Box 1578, Modern Plastics.

WANTED: Assembling, sorting, stringing, packaging and other such jobs on small plastic items. Work done on a contract basis. Well supervised in a certified workshop for handicapped persons. Call Contract Dept. Goodwill Industries, 123 E. 124th Street, N. Y. C. AT—9-9470.

MOLDS FOR PLASTIC RAZOR. Complete set of molds for manufacturing all plastic razors. Original cost, $12,000. Will consider reasonable offer. Excellent opportunity for injection molder with facilities in foreign country. Some razor parts and inserts also available. Eastern Plastics Syndicate, Irvington, N. J. Essex 5-0010.

GENERAL SUPERINTENDENT for compression molding plant located in the Middle West. Must be experienced in general molding compounds, electronics, preforming, hydraulic presses, dies, steam, water and air lines. Applicant must be excellent production man who can set up production standards and follow through and he must be capable of setting up plant system. An excellent future for the right man who can produce. State desired salary and references. Reply Box 1579, Modern Plastics.

WANTED: CHIEF ENGINEER to head engineering department covering all plant, product and mold engineering work and reporting direct to management. Must have ability to run department and to cooperate and coordinate in plant producing thermosetting and thermoplastic products with most up-to-date equipment. Mechanical engineering background preferred. Located in Connecticut. Give age, experience and salary requirements. Reply Box 1581, Modern Plastics.

FOR SALE: Hydraulic Presses, 1-self contained completely automatic 5 tons capacity; 1—20″ x 20″ 17″ dia. ram. 285 tons; 1—40″ x 40″ 16″ ram, 250 tons; 2—36″ x 36″ 14″ rams 154 tons; 1—24″ x 24″ 6″ ram 75 tons; 1—26″ x 52″ 14″ ram 400 tons; 1—20″ x 40″ 2—8″ rams 100 tons; 4—12″ x 12″ 7½″rams, 50 tons; 1—12″ x 12″ 6½″ ram with pushbacks; 2—15″ x 15″ 8″ rams 75 tons; 3—18″ x 20″ 10″ rams 78 tons; 3—13″ x 19″ 12″ rams 100 tons; 1—20″ x 20″ 13″ ram with pullbacks 200 tons; PUMPS; 1 HPM triplex 1½ GPM 2500#, 1—4 plunger 6 GPM 2000#; 1—Robertson Duplex 1½ GPM 4000#, 1 HPM triplex 1¼ GPM 2000# on high, 16 GPM 400# on low, V Belt Pulley, 1—Hele Shaw JLP 12, 44 GPM 1200# with new control; 2 Vickers Units 20 GPM 2000#, 1—Gould Triplex 12 GPM 1250#, 1 Worthington Triplex 12 GPM 2500#, 1 Elmes Duplex 1½ GPM 2850#, 1 Worthington 2½ GPM 4000#; Accumulator; 1 W&S new 6000# hydropneumatic unit, Extruders; Housatonic 6″ worm, Royle No. 2; Preforming Machines, 2 Stokes RDI, Kux Lohner Rotary type; Mills, Calenders, Mixers, Laboratory Presses, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 283 Hudson Street, New York City 13.

VETERAN—M.S. Organic Chemistry; 2 yrs., diverse experience in research and development. Desires to enter plastics field. Prefer NY vicinity. Reply Box 1583 Modern Plastics.

FOR SALE: HPM 500 ton Mold. Presses 42″ x 48″; D. & B. 500 ton 42″ x 48″; Farrel-Birm. 150 & 175 Ton: also 20 to 250 Tons from 36″ x 36″ to 12″ x 12″; 40 Ton Broaching Press; 400 Ton Extrus. Pr.; W. S. Hor. 4 Plgr. 1″ and 2″ x4″ H. & L. Pressure Pumps; HPM 1½″ x 6″ Vert. Triplex 10 GPM 2700 lbs.; 7 Hydr. Oil Pumps, Vickers, Oilgear, Northern, etc.; Wat.-Farrel 1¼″ x 4″ vert. triplex 6 GPM 3000 lbs.; Elmes 1″ x 4″ and 1½″ x 4″ hor. 4 plgr. 5 to 8 GPM 4500 lbs. and 5500 lbs.; Rumsey 4½″ x 8″ vert. triplex, 65 GPM 900 lbs.; Elmes 2½″ x 4″ hor. 2 plgr., 17 GPM 850 lbs.; 10 HP horiz. 1½″ x 4″ triplex 6 GPM 3000 lbs.; New Vickers 1½″ Oil Relief Valves; New Vickers ¾″ Flow Control Valves; 2—Adamson 6″ Extruders. Hydr. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Accum. Heavy Duty Mixers; Roller Conveyor, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 Broome St., NEW YORK 13, N. Y. CANAL 6-8147.

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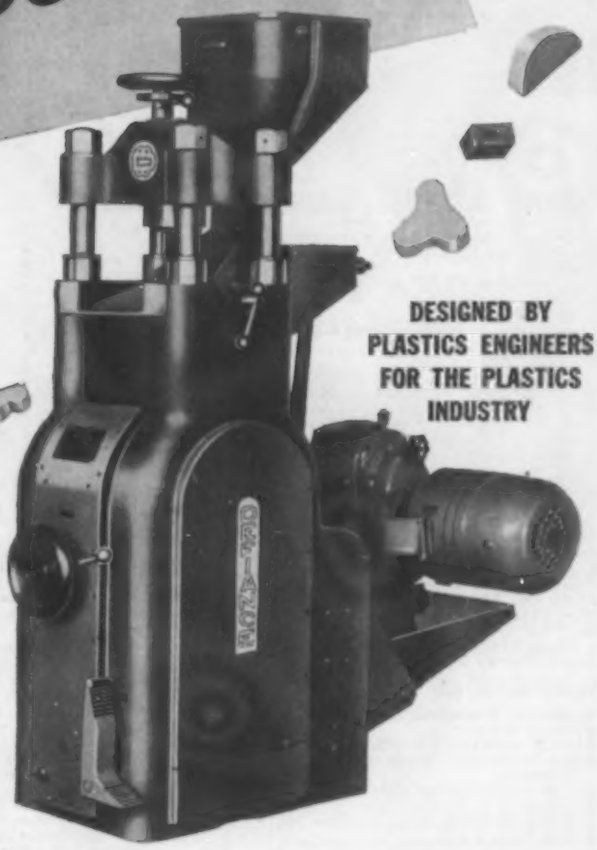

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MODERN PLASTICS

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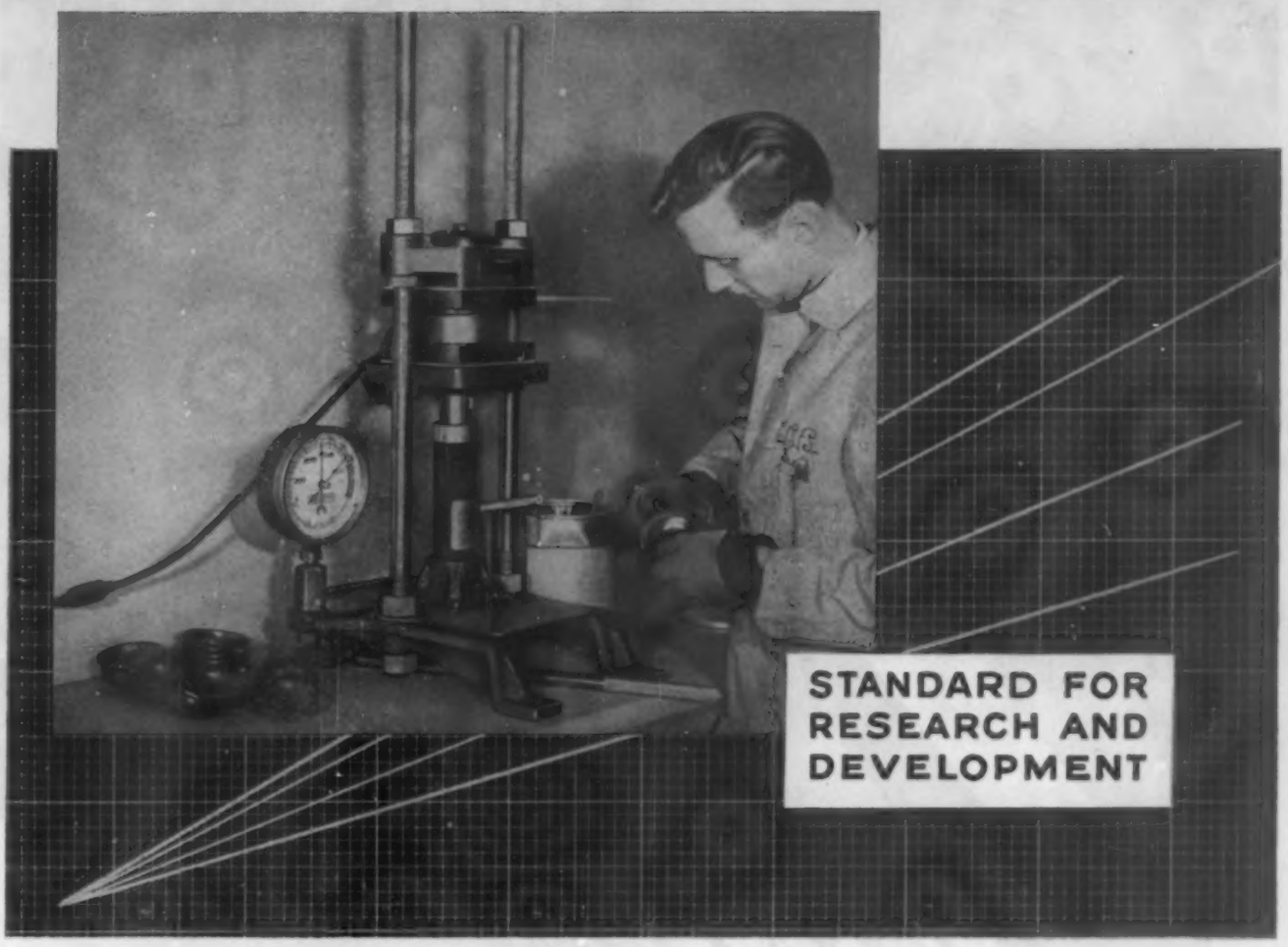

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